DISSERTATION ON

AN ANALYTICAL STUDY OF VITAMIN D DEFICIENCY IN CHRONIC KIDNEY DISEASE PATIENTS

Dissertation submitted to the

THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY

In partial fulfillment of the regulations

for the award of the degree of

M.D. GENERAL MEDICINE

(BRANCH I)

DEPARTMENT OF GENERAL MEDICINE
THANJAVUR MEDICAL COLLEGE
THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY

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DECLARATION

I solemnly declare that this Dissertation "**AN ANALYTICAL STUDY OF VITAMIN D DEFICIENCY IN CHRONIC KIDNEY DISEASE PATIENTS** is a bonafide work done by me in Department of General medicine, Thanjavur Medical College, and Hospital , Thanjavur during september 2013-june 2015 under the Guidance and Supervision of Professor Dr.K.NAGARAJAN M.D. Department of General Medicine, Thanjavur Medical College, Thanjavur.

This Dissertation is submitted to The Tamilnadu Dr. M.G.R Medical University , Chennai in partial fulfillment of University requirements for the award of M.D Degree (GENERAL MEDICINE).

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CERTIFICATE

This is to certify that this dissertation titled "**AN ANALYTICAL STUDY OF VITAMIN D DEFICIENCY IN CHRONIC KIDNEY DISEASE PATIENTS**" is a bonafide research work done by

Dr. M.SURESH, in the department of General Medicine,Thanjavur Medical college

, Thanjavur during his postgraduate course from 2013-2016. This is submitted as partial fulfillment for the requirement of M.D degree examinations – branch .(General Medicine)

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LIST OF ABBREVIATIONS

CKD - CHRONIC KIDNEY DISEASE.

VDR - VITAMIN D RECEPTOR.

KDOQI – KIDNEY DIALYSIS OUTCOMES QUALITY OUTCOME.

ACEI – ANGIOTENSIN CONVERTING ENZYME INHIBITOR.

ARB - ANGIOTENSIN RECEPTOR BLOCKER.

PTH – PARATHYROID HORMONE.

GFR – GLOMERULAR FILTRATION RATE.

HD - HAEMODIALYSIS.

PD – PERITONEAL DIALYSIS.

AKI – ACUTE KIDNEY INJURY.

AVF – ARTERIO VENOUS FISTULA.

RAS – RENIN ANGIOTENSIN SYSTEM

TRPV – TRANSIENT RECEPTOR POTENTIAL VANILLOID

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submitted by Dr. M. SURESH **of**

Dept. of GENERAL MEDICINE **Thanjavur Medical College, Thanjavur**

was approved by the Ethical Committee.

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Dated : 10.04.2015

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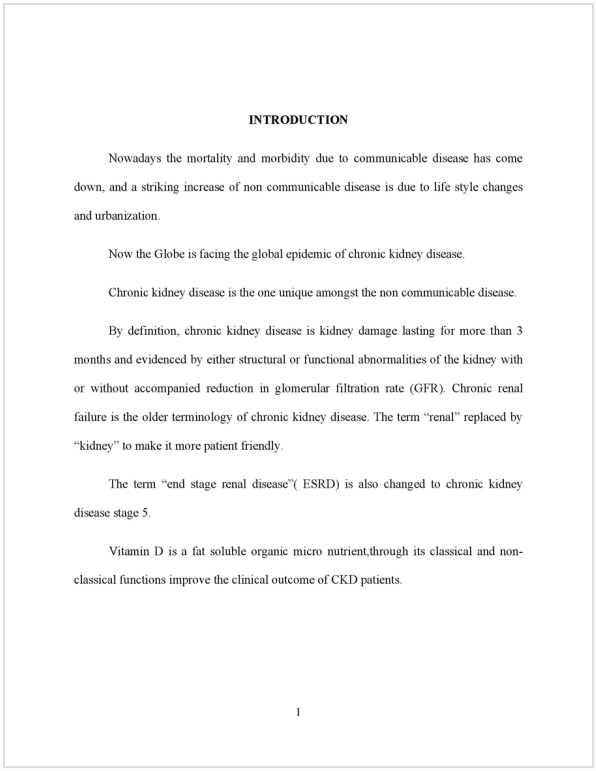

INTRODUCTION

Nowadays the mortality and morbidity due to communicable disease has come down, and a striking increase of non communicable disease is due to life style changes and urbanization.

Now the Globe is facing the global epidemic of chronic kidney disease.

Chronic kidney disease is the one unique amongst the non communicable disease.

By definition, chronic kidney disease is kidney damage lasting for more than 3 months and evidenced by either structural or functional abnormalities of the kidney with or without accompanied reduction in glomerular filtration rate (GFR). Chronic renal failure is the older terminology of chronic kidney disease. The term "renal" replaced by "kidney" to make it more patient friendly.

The term "end stage renal disease"(ESRD) is also changed to chronic kidney disease stage 5.

Vitamin D is a fat soluble organic micro nutrient,through its classical and non-classical functions improve the clinical outcome of CKD patients.

1

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Vitamin D is a fat soluble organic micro nutrient,through its classical and non-classical functions improve the clinical outcome of CKD patients.

VITAMIN D

Vitamins are a group of organic micro nutrients. They are essential for a variety of biochemical functions. Vitamins are broadly classified into fat soluble vitamins and water soluble vitamins.

Fat soluble vitamins are hydrophobic substances, can be absorbed efficiently only when there is normal fat absorption.

Vitamin D is a Lipid soluble vitamin, strictly speaking, vitamin D is not at all a vitamin, it is really a steroid hormone.

The terminology “vitamin D” denotes a group of closely related sterols produced by the action of ultra violet light on specific pro-vitamins.

SYNTHESIS AND CHEMISTRY OF VITAMIN D

Vitamin D3 is produced in the skin of mammals from 7– dehydrocholesterol by sunlight. The reaction sequence involves the rapid formation of previtamin D3.

Previtamin D3 converted to vitamin D3. Vitamin D3 and its hydroxylated derivatives are then carried in the circulation by binding to a globulin which is known as vitamin D- binding protein.

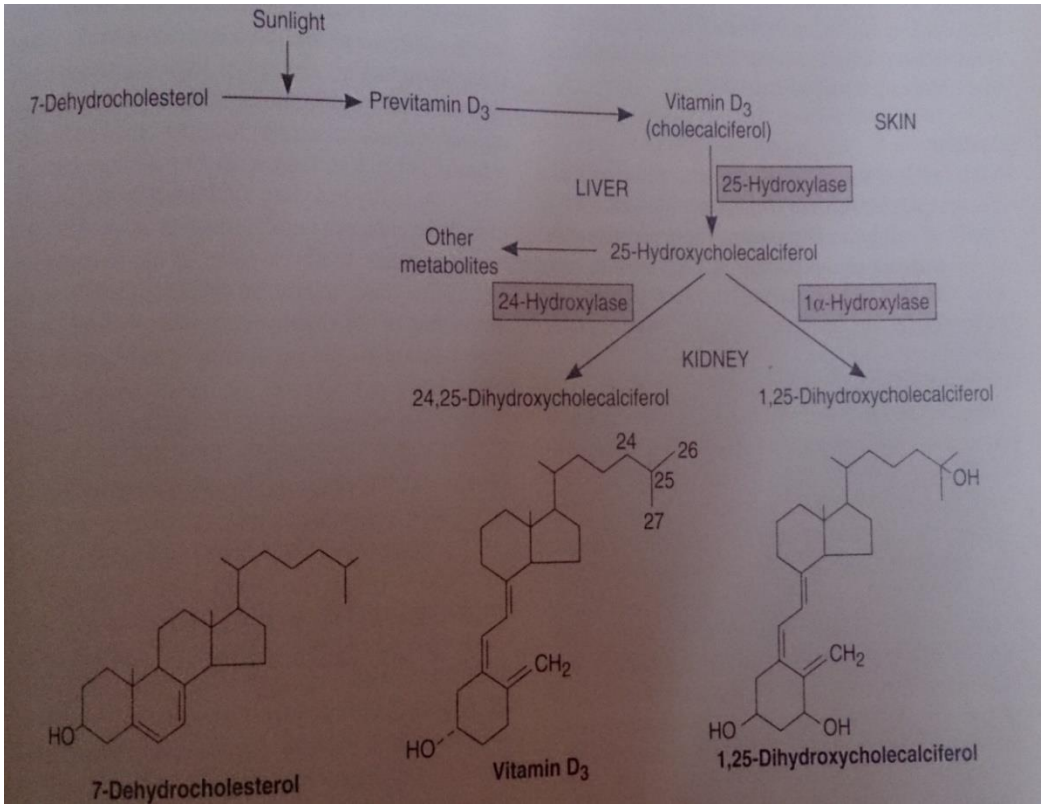
The affinity of vitamin D – binding protein for vitamin D3 is high, so it moves vitamin D3 from the skin into circulation. Under most conditions, sunlight is the major source of Vitamin D, when the sunlight exposure is inadequate, then dietary source is required.

Vitamin D3 is metabolized by cytochrome P450 (CYP) superfamily enzymes.

In the liver, vitamin D3 is converted to 25-Hydroxycholecalciferol (calcidol, 25-OHD3) by mitochondrial and microsomal CYP 450 enzymes.

FORMATION AND HYDROXYLATION OF VITAMIN D_3

FIGURE 1:



25-Hydroxy vitamin D3 [25 (OH) D3], is the major circulating and storage form of Vitamin D3.

The half life of 25 (OH) D3 is approximately two to three weeks.

The second hydroxylation, that is required for the formation of the mature hormone, occurs in kidneys.

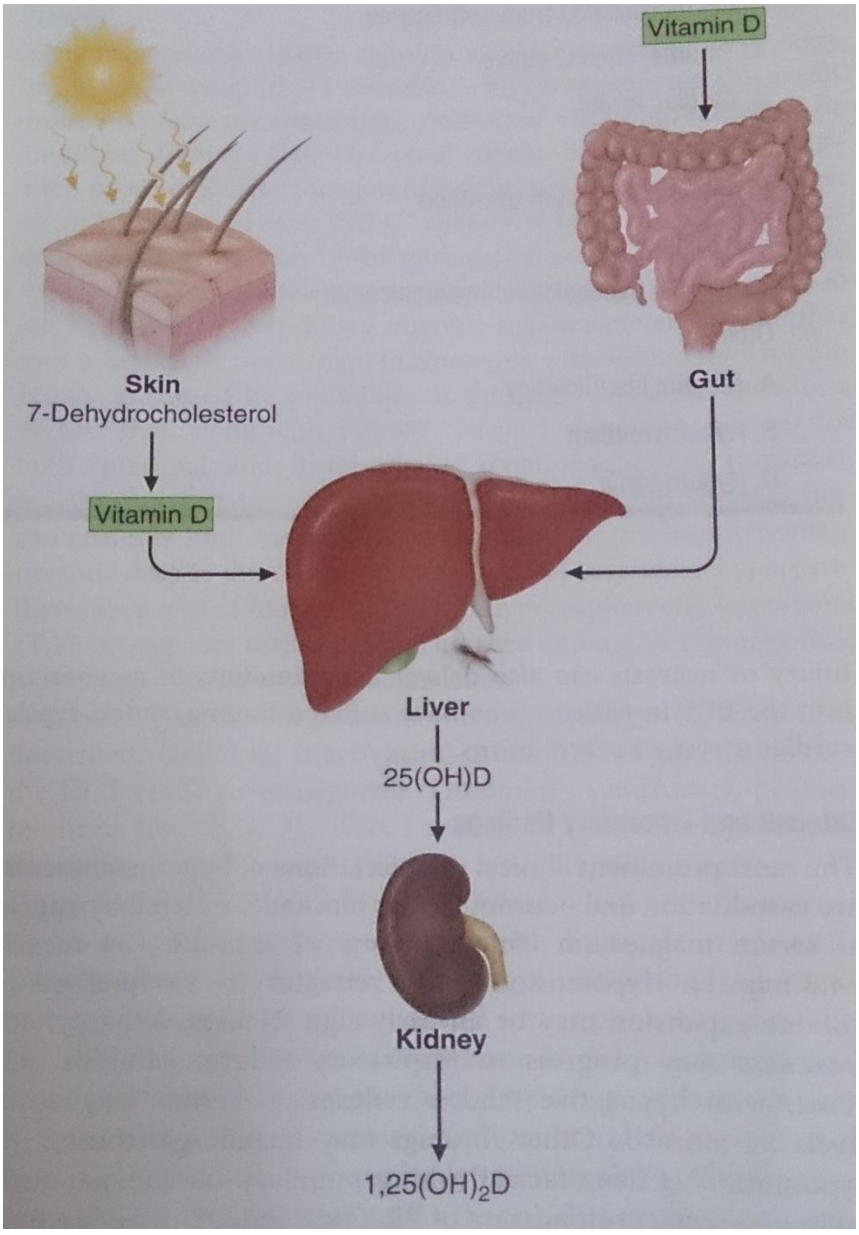
This 25- hydroxycholecalciferol converted in the kidneys to more active metabolite 1, 25-dihydroxy cholcalciferol, known as calcitriol (or) 1, 25 $(OH)_2$ D3. This hydroxylation mediated by 25-hydroxy vitamin D3-1-α hydroxylase. The normal plasma level of 25-hydroxy cholecalciferol is 30ng/ml, and normal valve of 1, 25 dihydroxycholecalciferol is around 0.03ng/ml.

Another less active metabolite that is also formed in the kidneys is 24,25 – dihydroxycholecalciferol.

Vitamin D3 and the derivatives of vitamin D3 are called as secosteroids.

SYNTHESIS AND ACTIVATION OF VITAMIN D

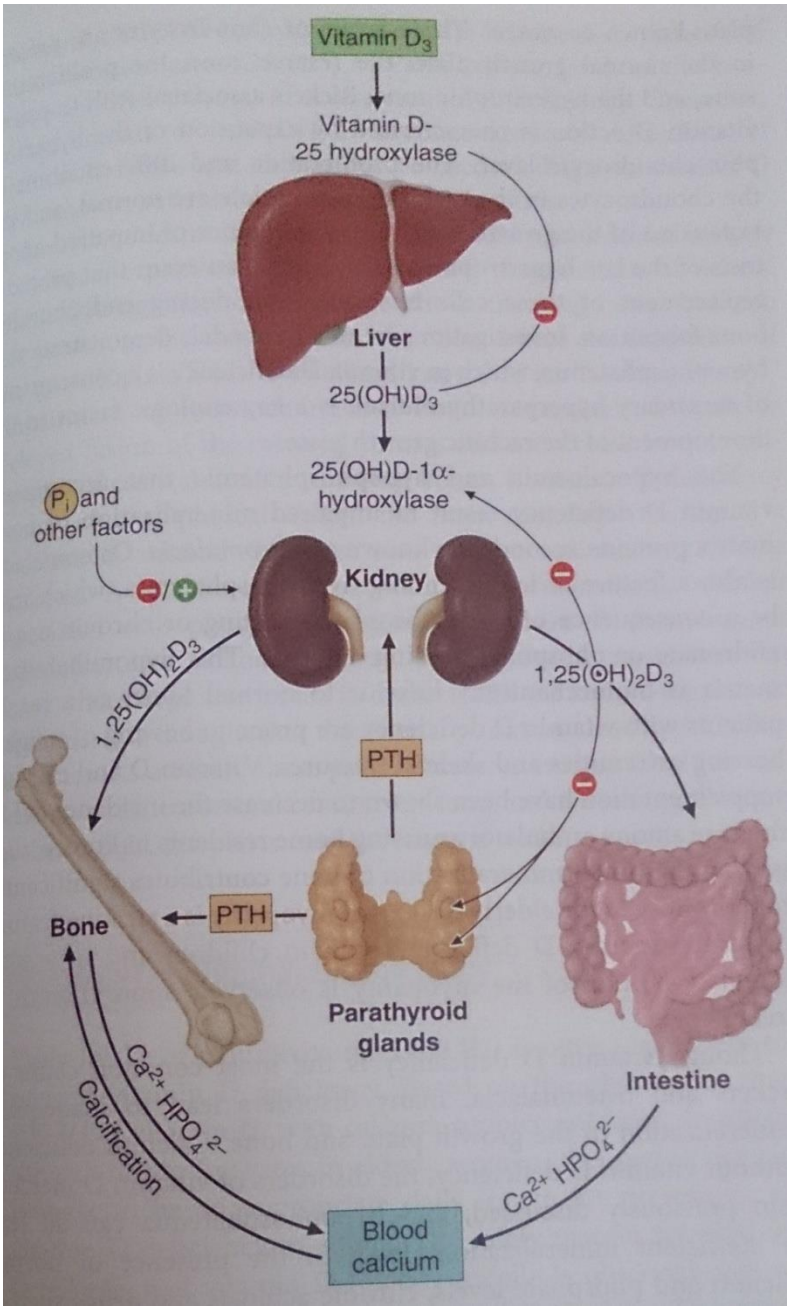
FIGURE:2



SCHEMATIC REPRESENTATION OF HORMONAL CONTROL LOOP

FOR VITAMIN D FUNCTION AND METABOLISM

FIGURE:3



Actions of Vitamin D

1, 25 $(OH)_2$ D3 regulates its biologic actions by binding to vitamin D receptors.

The affinity of VDR for 1, 25 $(OH)_2$ D3 is approximately three orders of magnitude higher than that of other Vitamin D metabolites.

The VDR binds to target DNA sequences as a heterodimer with retinoid X – receptors, results in the induction of target gene expression.

This VDR is expressed in wide range of cells and tissues. By inducing calbindin 9k, TRPV5 and TRPV6 in the small bowel 1,25 $(OH)_2$ D3 increases the efficiency of intestinal calcium absorption.

1, 25- dihydroxycholecalciferol facilitates Ca^{2+} reabsorption in the renal tubules. By the action on bone, it mobilizes bony Ca^{2+}, PO_4^{3-} by increasing the number of mature osteoclasts.

VDR is expressed in the parathyroid gland and vitamin D3 have antiproliferative effect on Parathyroid cells and to suppress the transcription of the parathyroid hormone gene. These effects of Vitamin D3 on parathyroid gland are an important part of the

rationale for current therapies directed at preventing and treating hyperparathyroidism associated with renal insufficiency.

Vitamin D3 has an anti proliferative effect on keratinocytes breast cancer cells and prostate cancer cells.

Vitamin D Deficiency

Is prevalent throughout the globe.

The clinical syndrome of hypovitaminosis D is due to

1) Deficient production of Vitamin D in the skin
2) Lack of dietary intake.
3) Accelerated losses of vitamin D.
4) Impaired vitamin D activation
5) Resistance to the biologic effects of 1,25 (OH)2 D3

Functional anatomy of kidney

Kidneys are two reddish brown organs, that are situated high up in posterior abdominal wall.

The right kidney is slightly lower than the left kidney because of large right lobe of liver.

During respiration both kidneys are move downwards in a vertical direction by as much as 2.5 cm due to contraction of diaphragm.

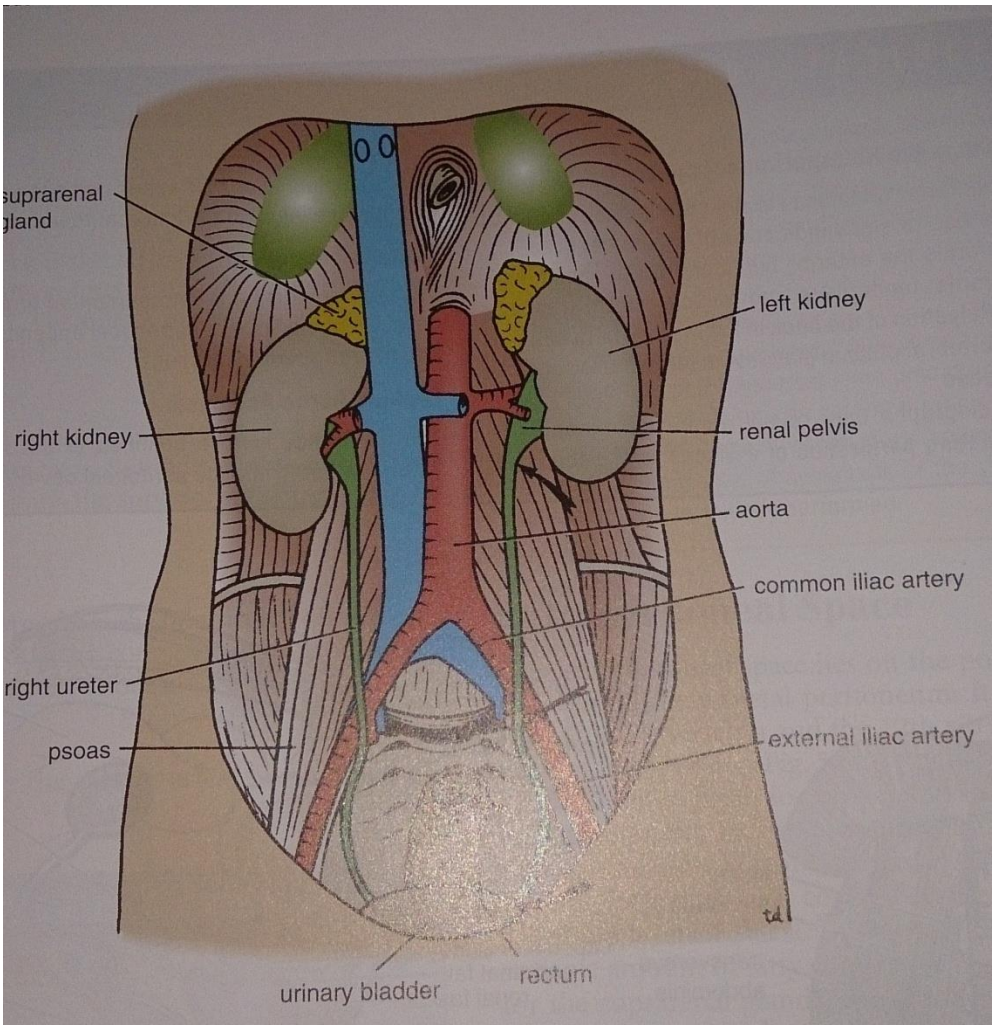
A vertical slit on the medial border of each kidney is bounded by thick lips of renal substance is called hilum. The hilum extends into a large cavity known as renal sinus. The hilum transmits, the renal vein, the two branches of renal artery,the ureter, the third branch of renal artery from the front backward. It also transmits lymph vessels and sympathetic fibers.

Coverings of the kidney

1) Fibrous capsule.
2) Perirenal fat.
3) Renal fascia.
4) Pararenal fat.

Posterior abdominal wall showing the kidneys

FIGURE:4



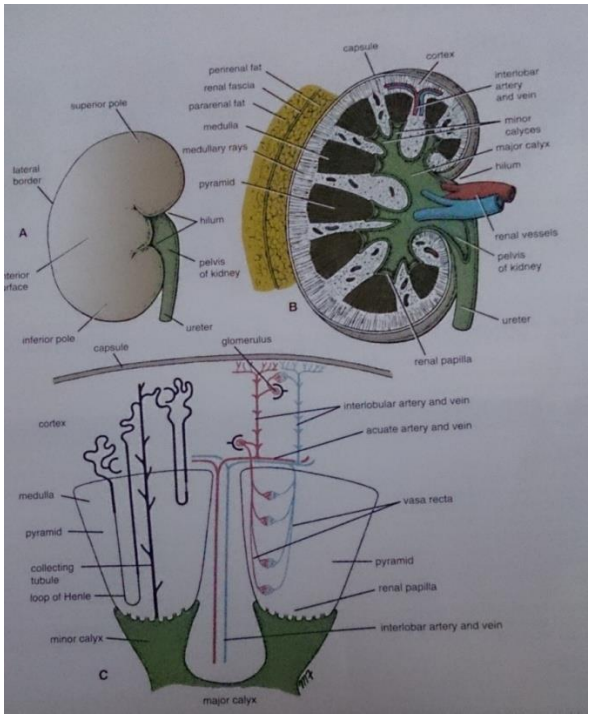
Renal structure

Each kidney has a dark brown outer cortex and an inner light brown medulla and the medulla has a dozen of renal pyramids. Each pyramid has its base oriented towards the cortex and its apex,the renal papilla, projecting medially. The renal columns are cortical extentions into the medulla between adjacent pyramids.

The renal sinus, a space in the hilum,consists the upper expanded end of the ureter,renal pelvis.

Renal pelvis divided into 2 to 3 major calyces,which in turn divided into 2 to 3 minor calyces. These minor calyx is indented by the apex of the renal papilla.

FIGURE 5 : CUT SECTION OF KIDNEY AND NEPHRONS



Blood supply of kidney

Arterial supply

Kidneys are supplied by the renal arteries arising from the abdominal aorta at the 2nd lumbar vertebrae level. Each renal artery divided into five segmental arteries that enter the hilum of the kidney and are distributed to different segments or areas of the kidney. From each segmental artery the lobar arteries arises one each for renal pyramid. Each lobar artery gives 2 to 3 interlobar arteries before they entering the renal substances. The interlobar arteries run toward the cortex on both sides of renal pyramid. The arcuate arteries arises from the interlobar arteries at the junction of the cortex and medulla arch over the bases of the pyramids. The arcuate arteries gives off many interlobular arteries that ascend in the cortex. The afferent glomerular arterioles arises from interlobular arteries.

Venous drainage

Each renal vein emerges from the hilum of the kidney in front of the renal artery and drains into the inferior vena cava.

Nerve supply

The nerve supply to the kidneys is from the renal sympathetic plexus. The afferent fibers from the renal plexus enter the spinal cord in the 10^{th},11^{th}, and 12^{th} thoracic nerves.

Functional anatomy

Nephrons are the basic functional unit of the kidney, composed of renal tubule and its glomerulus. The size of the kidney is largely determined by the number of nephrons in the kidneys. Each human kidney contains about 1.3 million nephrons.

The glomerulus, which is formed by invagination of a tuft of capillaries into the dilated blind end of the nephron. The size of the glomerulus is about 200 μm in diameter.

The capillaries are supplied by an afferent arteriole and drained by an efferent arteriole. In the bowmen's capsule two cellular layers separating blood from glomerular filtrate. The two layers are capillary endothelium and specialized capsular epithelium that is made up of podocytes. These two layers are separated by a basal lamina. Mesangial cells are a type of stellate cells,which are located between the basal lamina and the endothelial cells. Mesangial cells are equivalent of pericytes, which are found in the capillary walls, elsewhere in the body.

The mesangial cells are able to contract naturally and plays a vital role in the regulations of glomerular function. The mesangial cells also produce many substances, takes immune complexes and implicated in process of glomerular diseases.

Podocyte has numerous pseudopodias,which interdigitate and forms the filtration slit along the capillary walls.

Functionally, glomerular membranes allows free path of neutral substances up to 4nm size and excludes substances with diameter greater than 8nm. The total filtration area of glomerular capillary endothelium is about $0.8m^2$.

The proximal convoluted tubule in human is 15 mm long and 55µm in width and the wall is made up of a single layer of cells which interdigitate with one another and united by apical tight junctions.

Cortical nephrons which are present in the renal cortex are made up of short loop of henle.

Juxtamedullary nephrons which are present in the juxtamedullary region of the cortex are made up of long loops extending down into the pyramids. In human beings 15% of the nephrons have long loops.

The length of thin segment of the loop, varies from 2 to 14 mm and it ends with thick segment of the ascending limb, which is about 12 mm in length. The cells of thick ascending limb are cuboidal and have numerous mitochondria. The thick ascending limb reaches the glomeruli from there the tubule arose and passes close to its afferent and efferent arteriole. The afferent arteriole wall contain renin- secreting juxtaglomerular cells. Here the tubular epithelium is modified and form the macula densa. The juxtaglomerular cells,macula densa,and the lacis cells are collectively known as juxtaglomerular apparatus.

The distal convoluted tubule length is 5mm. The distal tubule coalesce and form collecting duct that are 20 mm in length and traverse through the renal cortex and the medulla to empty into the renal pelvis at the apex of the medullary pyramids. the collecting duct epithelium contains principal cells(P cells) and intercalated cells(I cells) .

The P cells are predominant cells in regulation of Na^+ reabsorption , vasopressin stimulated water reabsorption.

The I cells are very less in quantity, and involved in acid secretion and HCO_3^- transport.

CHRONIC KIDNEY DISEASE

"Chronic kidney disease" is a spectrum of different pathophysiologic processes that are associated with abnormal kidney function and a progressive decline in glomerular filtration rate.

KDOQI staging of CKD

Stage	**GFR, ml/min per 1.73m^2**
0	>90
1	> 90
2	60-89
3	30-59
4	15-29
5	<15

Stage 0- comprises patients with risk factor for CKD.

Stage 1 – comprises patients with demonstrated kidney damage.

The term "Chronic renal failure" applies to the process of continuing significant irreversible reduction in number of nephrons and typically corresponds to CKD stages 3 to 5.

The term “End stage renal disease” represents a stage of CKD, where the accumulation of toxins, fluid, electrolytes that are normally excreted by the kidneys resulting in uremic syndrome..

Risk Factors for CKD

1) Hypertension
2) Diabetes mellitus
3) Autoimmune disease
4) Older age
5) Previous episode of acute kidney injury
6) Proteinuria
7) Abnormal urinary sediment
8) Structural abnormality of urinary tract

Staging of CKD

For staging of CKD,it is necessary to estimate the GFR.

The two common formulas used to calculate e GFR are

1. Cockcroft – Gault equation

Estimated creatinine clearance (ml/min)

$$= \frac{(140\text{-age}) \times \text{body weight (kg)}}{72 \times P_{cr}\ (\text{mg/dL})}$$

Multiply by 0.85 for women.

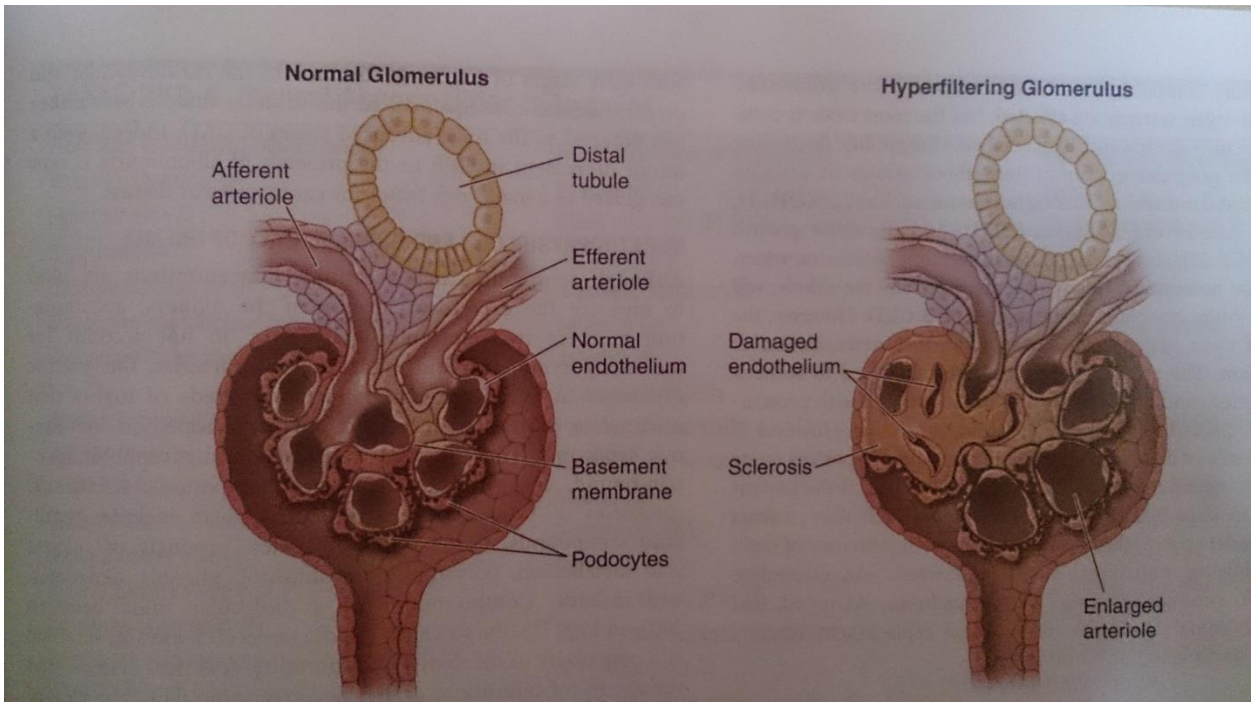
2. Equation from the " modification of Diet in Renal disease" study

Estimated GFR = $1.86 \times [P_{cr}]^{-1.54} \times (\text{age})^{-0.203}$

Multiply by 0.742 for women

Multiply by 1.21 for African Americans.

FIGURE:6 GLOMERULAR ARCHITECTURE



Normal Glomerulus (1) Hyperfiltering Glomerulus (2)

ETIOLOGY

Leading categories of etiologies of CKD

1) Diabetic glomerular disease
2) Glomerulonephritis
3) Hypertensive nephropathy
4) Autosomal dominant polycystic kidney disease
5) Other cystic and tubulo interstitial nephropathy

Classification of CKD by Pathology and etiology

Pathology	**etiology**
1) Diabetic glomerulosclerosis	Diabetes mellitus type 1 & 2
2) Glomerular disase	
Proliferative glomerulonephritis	SLE, vasculitis, Hepatitis B or C, HIV, Bacterial Endocarditis

Minimal change disease	Hodgkin diseases
Focal glomerular sclerosis	HIV, heroin toxicity
Membranous nephropathy	Drug toxicity, solid tumours
Fibrillary glomerular disease	Amyloidosis light chain disease
Hereditary nephritis	Alport's syndrome

3)<u>Vascular disease</u>

Disease of large size vessels	Renal artery stenosis, aorto arteritis
Disease of medium size Vessels (nephrosclerosis)	Hypertension
Disease of small vessels (microangiopathy)	Haemolytic uremic syndrome Vasculitis, sickle cell disease
Tubulo interstitial disease	Infections, drugs, sarcoidosis

Reflux nephropathy	Vesico – ureteric reflux
Obstructive nephropathy	Stones,prostatism, malignancy
Myeloma kidney	Multiple myeloma

Cystic Disease

Polycystic kidney disease	Autosomal dominant
Tuberous sclerosis	or
	Recessive
Von hippel – lindau disease	
Medullary cystic disease	

PATHOPHYSIOLOGY OF CHRONIC KIDNEY DISEASE

Two broad sets of mechanisms of damage

(1) Initiating mechanisms specific to underlying etiology

(2) A set of progressive mechanisms involving hyper filtration and hypertrophy of the remaining viable nephrons that are common consequence following long-term reduction in renal mass, irrespective of the underlying etiology. The responses to reduction in nephrons are mediated by vasoactive amines, cytokines and growth factors. Subsequently, the short term adaptations in the form of hyper filtration and hypertrophy becomes maladaptive with sclerosis and dropout of the remaining nephrons. Increased intrarenal activity of renin-angiotension axis contribute both the initial adaptive hyper filtration and to subsequent maladaptive hypertrophy and sclerosis. TGF – B stimulation also contribute to sclerosis of nephrons.

PATHOPHYSIOLOGY OF UREMIA

The pathophysiology of uremic syndrome divided into manifestation of three spheres of dysfunction.

1) Those consequent to the accumulation of toxins and metabolites that are normally undergo renal excretion, including products of protein metabolism.

2) Those consequent to loss of other renal functions, such as, fluid and electrolytes homeostasis and hormone regulation.

3) Progressive systemic inflammation and its vascular and nutritional consequences.

CLINICAL AND LABORATORY MANIFESTATIONS OF CHRONIC KIDNEY DISEASE AND UREMIA

Uremia leads to disturbances in every organ system function.

1) Fluid, electrolytes and acid – base disorders

a) Sodium and water homeostasis

In stable CKD patients, the total body content of sodium and water is modestly increased, this leads to extra cellular fluid volume (ECFV) expansion and contributes to hypertension.

Thiazide diuretics are limited utility in CKD stage 3 – 5, they need administration of loop diuretics. Ongoing diuretic resistance with intractable edema and hypertension in advanced CKD is an indication to initiate dialysis.

b)Potassium Homeostasis

Hyperkalemia is common in CKD due to increased dietary potassium intake, protein catabolism, haemorrhage, metabolic acidosis and due to medications like ACEI, ARBs and potassium sparing diuretics.

Diabetic kidney disease, obstructive uropathy, sickle cell uropathy associated with hyporeninemic hypoaldosteronism, cause more severe disruption of potassium secretory mechanisms in distal nephron causing hyperkalemia.

c) Metabolic acidosis:

It is a common abnormality in CKD. Most patients with CKD, produce less ammonia and hence, cannot excrete the normal quantity of protons in combination with urinary buffer. In addition, hyperkalemia depresses ammonia production. The combination of hyperkalemia and hyperchloremic metabolic acidosis is often present, and it a non-anion gap metabolic acidosis. With worsening renal function, the net urinary acid excretion is limited and retained anions of organic acids lead to anion gap metabolic acidosis. In most patients with CKD, the metabolic acidosis is mild, and usually be corrected with oral sodium bicarbonate supplementation.

2) Disorders of calcium and phosphate metabolism:

Manifested in skeleton and vascular bed

a) Bone manifestations of CKD

Classified into

1)High bone turnover with increased PTH levels

[Including ostetitis fibrosa cystica]

2)Low bone turnover with low or normal PTH levels

(adynamic bone disease and ostemalacia)

b)Cardiovascular system manifestations

Hyperphosphatemia is a major risk factor for increased cardiovascular mortality in patients with CKD.

Hyperphosphatemia and hypercalcemia in CKD are associated with increased vascular calcification.

Calciphylaxis [calcific uremic arteriolopathy) is a dreaded complication seen almost exclusively in advanced CKD patients. It appears as livedo reticularis, and progress to necrotic lesions in the legs, thigh, abdomen and breasts. It is seen in advanced hyperparathyroidism, increased use of oral calcium as a phosphate binder, and as a complication of warfarin therapy in haemodialysis patients.

Optimum management of secondary hyperparathyroidism and osteitis fibrosa is prevention. Current KDOQI guidelines recommends target PTH level between 150 and 300pg/ml.

This can be achieved by

- Low – phosphate diet
- Phosphate binder [calcium acetate, calcium carbonate, lanthanum, sevelamer]
- Calcitriol
- Calci mimetic agents –cinacalcet

3) Cardiovascular abnormalities

- Leading cause of morbidity and mortality in patients with any stage of CKD
- The incremental risk of cardiovascular disease in CKD patients is 10 to 200 fold when compared to age and sex matched general population.

a) <u>Ischemic vascular disease</u>

CKD augments the process of

- Occlusive coronary disease
- Cerebro vascular disease
- Peripheral vascular disease

Risk factors for cardiovascular disease in CKD

Traditional	**Non – Traditional (CKD related)**
Hypertension	Anemia
Hypervolemia	Hyper phosphatemia
Dyslipidemia	Hyperparathroidism
Sympathetic over activity	Sleep apnea
Hyper homocysteinemia	generalized inflammation

b)Heart failure

c)Hypertension and left ventricular hypertrophy

In all CKD patients, blood pressure should be controlled to levels recommended by national guideline panels.

- Salt restriction should be the first line of therapy
- Antiphypertensive agent choice is similar to that of general population.

Lifestyle changes, including regular exercise should be advocated in the management of cardiovascular disease.

Hyperlipidemia is managed with dietary measures and lipid – lowering medications such as statins.

b) **Pericardial disease**

Pericarditis, pericardial effusion is seen in advanced uremia. It is now more commonly observed in underdialyzed, non adherent patients than those in starting dialysis.

Uremic pericarditis is an absolute indication for emergency dialysis and for intensification of dialysis prescription.

4) Hematologic abnormalities

a) Anemia

A normochromic, normocytic anemia is observed in stage 3 CKD, and is almost always by stage 4.

Primary cause of anemia in CKD is insufficient production of erythropoietin (EPO)

The treatment of anemia in CKD patients are oral iron supplementation, IV iron infusion, vitamin B_{12} and folate, administration of recombinant human EPO and modified EPO products.

b) Abnormal hemostasis

Patients with advanced CKD have increased tendency to bleeding and bruising due to prolonged bleeding time, abnormal platelet aggregation and adhesion.

Optimal dialysis restores hemostatic abnormalities.

5) Neuro muscular abnormalities

CNS, PNS, ANS, muscle structure and function abnormalities are well recognized complication of CKD.

Subtle clinical manifestations become evident at stage 3 CKD.

Early manifestations are memory disturbances, sleep disturbances.

Neuromuscular irritability such as hiccups, cramps, twitching occurs at later stages.

In advanced renal failure, asterixis, myoclonus, seizures and coma occurs.

Peripheral neuropathy usually evident of stage IV CKD. Most of the manifestations, described above resolved by dialysis.

6) Gastrointestinal and nutritional abnormalities

Uremic fetor.

Anorexia, nausea, vomiting.

Gastritis, peptic disease, mucosal ulceration.

Protein – energy malnutrition is common in advanced CKD.

Assessment of protein – energy malnutrition begin at stage 3 CKD.

7) Endocrine – metabolic abnormalities

- Glucose metabolism is impaired in CKD
- Due to diminished renal degradation of insulin, the dose of insulin therapy need progressive reduction in dose.

In women with CKD, estrogen levels are low, hence, menstrual irregularities and high rate of spontaneous abortion are common.

In men, there is decreased plasma testosterone level and sexual dysfunction oligospermia may supervene.

8)Dermatologic abnormalities

Pruritus is very common.

Urochromes – due to deposition of retained pigmented metabolites.

Nephrogenic fibrosing dermopathy – unique to CKD patients, consists of progressive subcutaneuous induration, especially on the arms and leg.

Haemodialysis improve the cutaneous abnormalities but not the pruritus.

Approach to patients with CKD

1)History and physical examination.

Enquire about history of hypertension, diabetes mellitus, abnormal urinalysis and problems with pregnancy such as pre eclampsia or early pregnancy loss.

A careful drug history should be warranted. A careful family history of kidney disease should be elicited.

The physical examination should focus on blood pressure and target organ damage from hypertension. Thus fundoscopy and precordial examination should be carried out. Look for edema and sensory polyneuropathy.

2)Laboratory examination

Lab studies should focus to find the clues of the underlying causative or aggravating disease process.

Serial measurements of renal function should be done to determine the pace of renal deterioation, serum concentration of calcium, phosphorus, vitamin D, PTH, haemoglobin level, iron, B_{12}, folate level and 24-h – urine protein excretion all should be measured.

Imaging studies

Renal ultrasound is the most useful imaging study. It verifies the presence of two kidneys, determine their symmetricity, allow an estimation of kidney size.

. Doppler sonography, nuclear medicine studies, CT or MRI to diagnose renovascular disease. A voiding cystogram to rule out reflux nephropathy.

Treatment of CKD

Treatment strategy aimed at specific causes of CKD. These include strict glucose control in DM and immunomodulatory agents for glomerulonephritis. It is useful to sequentially measure and plot the rate of decline of GFR in all patients.

A thorough search for aggravating factor is warranted to reverse the acute or subacute process in the setting of CKD.

Clinical action plan

stage	description	GFR, ml/min per 1.73m^2	Action
1.	Kidney damage with normal or ↑ GFR	≥90	Diagnosis and treatment of comorbid conditions, slowing of progression of CVD risk reduction.
2.	Kidney damage with mild ↓ GFR	60-89	Estimating progression.
3.	Moderate ↓GFR	30-59	Evaluating and treating complications
4.	Severe ↓ GFR	15-29	Preparation for kidney replacement therapy.
5.	Kidney failure	≤15	Kidney replacement.

Slowing the progression of CKD

Reducing intra glomerular hypertension and proteinuria

Control of blood glucose

Control of blood pressure and proteinuria

Protein restriction

Indication for dialysis

Fluid overload or pulmonary edema refractory to diuretics.

Uremia: Pericarditis, persistent nausea, vomiting, bleeding due to platelet dysfunction, progressive uremic encephalopathy.

Refractory hyperkalemia

Metabolic acidosis

Serum creatine above 10mg/dl

Renal replacement therapies

The renal replacement therapies are chronic maintenanance haemodialysis, chronic peritoneal dialysis and kidney transplantation. Kidney transplantation is the treatment of choice in end stage renal disease(ESRD).

Dialysis

The term “dialysis” was coined by Thomas graham, professor of chemistry at Anderson university in Glasgow in 1861. The first successful human dialysis was performed by George hass from germany in 1924. In 1943 the first practical human haemodialysis machine was developed by kolf and berk from Netherlands. This first machine was rotating drum articifial kidney consisted of 30 to 40 meters of cellophone tubing in a stationary 100 litres tank.

Use of dialysis was restricted to acute renal failure from 1943 to 1960(ARF). The discovery of arteriovenous shunt by Quinton and scribner in 1960 and forearm arteriovenous fistula by Brescia and cimino in 1966 extended this modality of therapy to chronic end stage renal failure.

Chronic maintenance haemodialysis, now emerged as one of well established life sustaining therapy in terminally ill end stage renal failure patients.

In India, the first successful haemodialysis was started by Christian medical college, vellore, Tamilnadu.

Selection of dialysis

Selecting one of the dialysis modalities is influenced by many factors, such as availability,convenience, comorbid conditions, socio-economic, and haemodynamic stability. Most CKD patients can be treated with either peritoneal dialysis (PD) or haemodialysis (HD). Continuous ambulatory peritoneal dialysis (CAPD) is the preferred dialysis modality in young children, elderly patients in whom vascular access is not available and in haemodynamically unstable patients. In a single patient all modalities of dialysis can be utilized. In the beginning start with PD when residual kidney function is present and later on switch over to HD when the patient becomes anuric.

Principles of dialysis

Diffusion

If different concentrations of two solutions are separated by a semipermeable membrane, solution from the side of high concentration will move to lower solute concentration side. This solute movement process on a concentration gradient is known as diffusion.
The diffusion rate is highest when the concentration is high. This is the principle mechanism for clearance of urea, creatinine and for replenishment of serum bicarbonate. Other determining factors of diffusion are solution temperature, viscosity, molecule size, and membrane characteristics.

Ultrafiltration

This is a convective transport. Due to the extremely smaller molecular size, water can pass through all semipermeable membrane and ultrafiltration occurs when water driven by either an osmotic or a hydrostatic force pushed through the membrane. The solutes that can pass easily through the membrane pores are swept along with the water and this process is known as “solvent drag”. This principle is mainly used for removal of water from body.

Clinically, both diffusion and ultrafiltration movement take in and out of blood, across a semipermeable membrane. If the blood is exposed to an artificial membrane outside the body, i.e. extracorporeal circulation, the process is known as haemodialysis or haemofiltration. If the exchange of molecules takes place across the peritoneal membrane,the process is known as peritoneal dialysis(PD).

Haemodialysis

Components of haemodialysis.

1)Blood circuit.

2)Dialysis fluid circuit.

3)Dialyzer.

Vascular access

It is the lifeline for the patient and Achilles heel of HD. The vascular access help to draw blood continuously from the patient at a required rate of between 200 to 400 ml per minute and return to the patient after circulating it through the artificial kidney.

Temporary vascular access

This is for patients requiring shorter period of HD, such as those with AKI, and patients waiting for permanent access requires urgent dialysis.

Preferred vascular access sites.

1)Right internal jugular vein

2)Femoral vein

3)Left internal jugular vein

4)Right subclavian vein.

Permanent vascular access

Native arteriovenous fistula (AVF) ,non-dominant radio-cephalic is the vascular access of choice for long-term maintenance haemodialysis. AVF has longest life with least complications, so arm veins should be preserved in all patients likely to require dialysis.

AVF should be construted when GFR falls below 25ml/min ,AVF takes 3 – 4 months for its full development and it should not be used at least one month after its creation.

Frequency of dialysis

A four hours dialysis of three cycles per week is desirable. Dialysis frequency should be increased for patients with cardiovascular problems.

Complications of hemodialysis

Acute vascular access/ fistula related	Haemorrhage, haemothorax, pneumothorax.
Chronic AVF related	Infection, aneurysm, steal, venous congestion, high output failure.
Extra corporeal circulation procedure related	Dialyser reactions, type A anaphylactic reactions, hypotension, hypoxia, cramps, fever, chills, dialysis disequilibrium, air embolism.
Chronic complications	Hepatitis B and C infections, metabolic bone disease, worsening of anaemia,dialysis dementia.

Peritoneal dialysis

The physiological basis of this technique across the peritoneum entails the process of diffusion, connective transport and osmosis. In PD, solute and fluid exchange occurs between the peritoneal capillaries and the dialysis solution in the peritoneal cavity.

Components of PD

1) PD catheter
2) PD solution
3) Peritoneal membrane with its associated vasculature.

Peritoneal dialysis modalities

1) Continuous ambulatory peritoneal dialysis
2) Continuous cycling peritoneal dialysis
3) Nocturnal intermittent peritoneal dialysis
4) Tidal peritoneal dialysis.

Complications of peritoneal dialysis

Technical complications : catheter related exit site infection, tunnel infection, peritonitis.

Raised intra-abdominal pressure: hernias, fluid leak, prolapsed rectum,vagina

Renal transplantation

The first successful renal transplantation done in 1956 in USA. In India , in 1971 first successful renal transplantation done in Christian medical college, vellore. Currently about 3500 renal transplants are done annually in India.

Transplantation immunology

There are three phases of immune response to a transplanted allograft.

1) Recognition of foreign antigens.
2) Activation of antigen specific lymphocytes.
3) Effector phase of graft rejection

Drugs for immunosuppresion

Currently in india, most patients receiving a triple drug regimen including tacrolimus,mycophenolate mofetil, and prednisolone for the maintenance of immunosuppression.

Transplantation procedure

The donar nephrectomy can be done laparoscopically and this reduces the morbidity and the hospital stay. The recipient has the allograft implanted in the iliac fossa with the anastomosis of the donar vessels to the iliac vessels and the ureter implanted into the recipient bladder using antireflux technique.

Post-transplant complications

1) Infections.
2) Rejection.
3) Vascular disorders.
4) Recurrence of glomeruler disorders.

Survival after transplantation.

Survival after transplantation in india at 1,5 and 10 years is about 97%, 80&, 60% respectively.

Immunosuppressive therapy

A combination of drugs are used to prevent graft rejection.The commonly used drugs are steroids, calcineurin inhibitors (cyclosporine, tacrolimus), azathioprine, mycophenolate mofetil.

Complications: Hyperacute rejection, acute rejection, chronic rejection, infection.

Vitamin D and CKD

CKD is a public health problem and a powerful predictor of premature cardiovascular complications may be linked to vitamin D deficiency. CKD patients have a high rate of severe hypovitaminosis D.

Vitamin D plays a vital role as a cell differentiating and anti-proliferative factor with actions in a wide variety of tissues. In CKD patients the new non classical role of Vitamin D also encompasses regulation of renin angiotensin system and the nuclear factor (NF) kB pathway, both are implicated in wide variety of chronic disease.

Numerous evidences conclude adequate replacement of Vitamin D potentially reduce premature morbidity and mortality in CKD patients.

Non classical role of vitamin D:

Research evidences highlights a peripheral autocrine pathway, for production of calcitriol in non-renal tissues. Calcitriol synthesized in this peripheral tissues mediates the reactions that bridge the external stimuli to gene transcription.

This non classical pathway discovery ignites new significance to the importance of addressing nutritional Vitamin D deficiency given the potential role that hypovitaminosis D may play in multiple chronic disease Vitamin D deficiency is in greater degree in patients with CKD.

Non classical role of Vitamin D in CKD

Kidneys appear to be a major target organ for both classical and non classical functions of Vitamin D, due to highly expression of Vitamin D receptors in the kidneys.

The specific pathway that is regulated by the autocrine function of Vitamin D in the CKD patients is the renin- angiotensin system .

The resulting sequence activates angiotensin II, in CKD patients, have harmful effects on blood pressure and vascular tissue, and lead to renal parenchymal damage.. These deleterious effects are reversed through modulation of RAS system, by the effects on blood pressure and on the dysregulated vascular and cardiac function.

In experimental models of different stages of CKD, administration of activated vitamin D analogs, results in suppressed activation of RAS system along with concurrent reduction of glomerular and tubulointerstitial destruction leads to improvement in blood pressure.

Another significant role of RAS is in diabetic nephropathy, a leading cause of CKD.

Hyperglycaemia and vitamin D deficiency both are strong stimulators of the intra renal component of the RAS. In experimental diabetic models vitamin D analogues supplementation have a therapeutic advantage by potentiating the traditional inhibitors of RAS.

Albuminuria is one of the classical sign of nephropathy. Research evidences demonstrate the negative relationship between the level of Vitamin D and degree of Albuminuria. These findings suggested that vitamin D also have anti proteinuric effect likely via RAS mediated mechanism.

Besides its roles in progression of kidney disease and proteinuria, the locally synthesized intrarenal angiotensin II has a harmful outcome on the cardiovascular system by its effect on blood pressure, vascular smooth muscle cells and cardiac myocytes. Since cardiovascular disease is the predominant cause of death in CKD patients the potential role of Vitamin D supplementation to positively regulate this RAS system may be quiet significant in affecting the premature death associated with CKD.

NF – kB pathway

Another important pathway in CKD, which may be regulated by the non classical autocrine actions of vitamin D is the NF – kB pathway. NF – kB refers to a group of transcription factors which modulate the genes involved in the immune responses, inflammatory processes and fibrosis, the factors implicated in the pathogenesis of CKD. Stimulation of NF – kB pathway activates a series of events results in production of cytokines, chemokines ,many other inflammatory factors, which exacerbates tissue injury in the renal disease process.

Treatment

Due to progression of CKD, the renal mass decreases, as well as the capacity of renal hydroxylation of 1, 25 vitamin D diminishes and 1, 25 vitamin D deficiency occurs. Therefore repletion of 1, 25 Vitamin D either by using calcitriol or its analogues is mandatory to overcome the compromised production of 1,25 vitamin D, so that the classical functions of 1, 25 vitamin D to be established.

All patients with CKD are considered to have sub optimal level of Vitamin D when serum values less than 30-32ng /ml and several recent reports suggest that optimal serum level of 25(OH) vitamin D should be between 40 to 80ng/ml.

Since Vitamin D does not naturally occurs in most foods the use of vitamin D supplements is now almost universally required.

Supplementation can be safely achived with the use of vitamin D3 or D2 in the oral formulation.

Vitamin D3 (or) cholcalciferol, the natural form of the vitamin D, is the superior form and have some advantage over vitamin D_2 (ergocalciferol) by increased potency and decreased rate of metabolic degradation.

In CKD patients supplementation of 25(OH) vitamin D is recommended at the inception of the disease with the addition of calcitriol in stage 3.

Newer studies suggest that doses as high as 4000 IU daily may be required to maintain optimum vitamin D levels in normal population and it is extrapolated that higher doses may be required in CKD patients to overcome the more profound deficits to which they are prone. To achieve adequate repletion one common estimation is that each

100 IU of vitamin D administration will raise the serum 25(OH) vitamin D level by 1ng/ml.

Conclusion

Vitamin D has established as a vital compound in the management of CKD with newly ascribed autocrine functions vastly different from its classical function over mineral homeostasis. To ignore vitamin D importance, and its potential impact on mortality and morbidity in CKD patients are no longer appropriate. In addition to the traditional supplementation of 1, 25 vitamin D to CKD patients, by assessing vitamin D deficiency and eliminating the deficiency with vitamin D, the physicians will adequately fuel both the renal and extra renal pathways of calcitriol synthesis maintaining the classical and non classical functions of vitamin D that ultimately influence the clinical outcome in CKD patients.

AIMS AND OBJECTIVE

To evaluate the vitamin D deficiency in chronic kidney disease patients in relation to gender, diabetes mellitus, systemic hypertension.

MATERIALS AND METHODS

SETTING : **INPATIENTS**

OUTPATIENTS

HOSPITAL : **THANJAVUR MEDICAL COLLEGE HOSPITAL**

THANJAVUR.

ETHICAL COMMITTEE APPROVAL : **YES OBTAINED**

DESIGN OF STUDY : **OBSERVATIONAL AND PROSPECTIVE**

SINGLE CENTERED STUDY

PERIOD OF STUDY : **2013 SEPTEMBER TO 2015 JUNE**

SAMPLE SIZE : **60 PATIENTS**

SELECTION OF PATIENTS

INCLUSION CRITERIA

PATIENTS WITH CHRONIC KIDNEY DISEASE STAGE 2 – 4

EXCLUSION CRITERIA

1. CKD PATIENTS ON DIALYSIS THERAPY
2. CKD PATIENTS ON VITAMIN D SUPPLEMENTATION.

STUDY METHODOLOGY

60 patients with chronic kidney disease were selected for the study. Patients on dialysis and on Vitamin D therapy were excluded from the study.

15 female patients, 15 male patients with CKD with diabetes mellitus, 15 male patients with hypertension, 15 male patients without diabetes mellitus and hypertension were selected for the study.

Diagnosis of CKD over based on history, clinical features, USG abdomen and renal function test and eGFR

The following investigations were done on admission:

1. Complete blood count
2. Random blood sugar
3. Serum urea and creatinine
4. Serum vitamin D level
5. Serum electrolytes
6. USG abdomen
7. Fasting and post prandial blood sugar
8. ECG
9. Urine analysis

MEASUREMENT OF VITAMIN D

For assessing vitamin D status the best indicator is circulating 25 hydroxyl vitaminD (25 OH D) .

Currently used 2 main methods are

1.competitive immune assay

2.chromatographic separation followed by non- immunological direct detection[HPLC, LC-MS/MS].

Our study based on fully automated chemi luminescent immuno assay (LC-MS/MS) which employs non-immunological direct detection.

The currently used LC-MS/MS method used automated platform.

According to this method vitamin D status measured as

Deficiency : <20 ng/ml

Insufficiency : 20-30ng/ml

Sufficiency : 30-100 ng/ml

Toxicity : >100ng/ml

OBSERVATION AND RESULTS

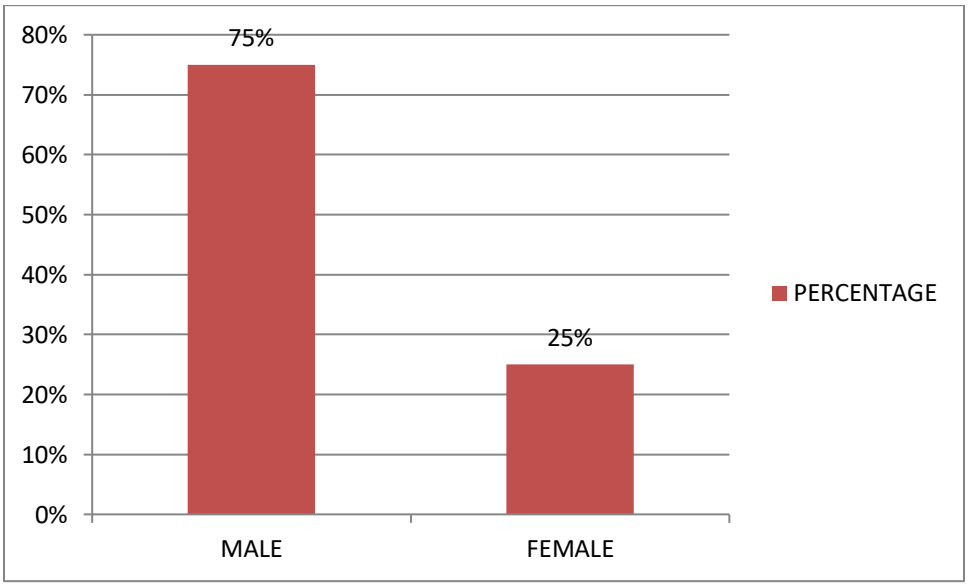
60 Chronic kidney disease patients were included in the study. Serum vitamin D level was measured and results were analysed.

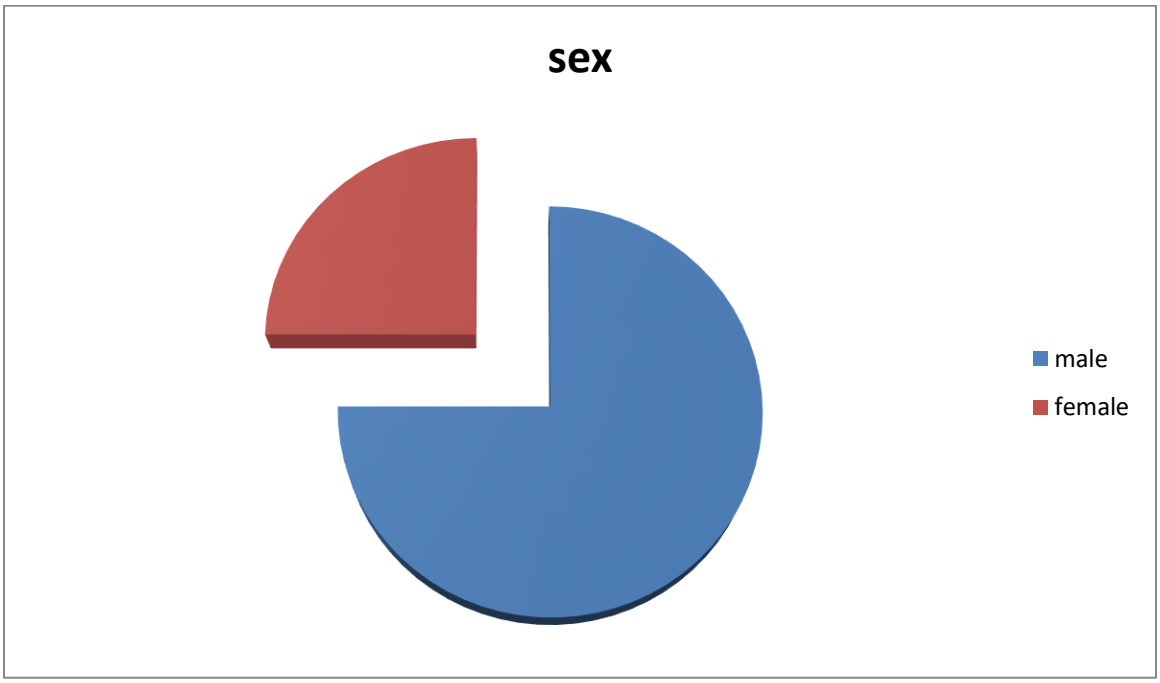
Among the 60 chronic kidney disease patients 15 were Female and 45 were male. Patients selected for study.

TABLE -1 : SEX DISTRIBUTION IN THE STUDY

SEX	NUMBER OF PATIENTS	PERCENTAGE
MALE	45	75%
FEMALE	15	25%

FIGURE 7 : SEX DISTRIBUTION IN THE STUDY





STAGE OF CKD

This study includes CKD patients with stage 2-4.

Out of 60 patients

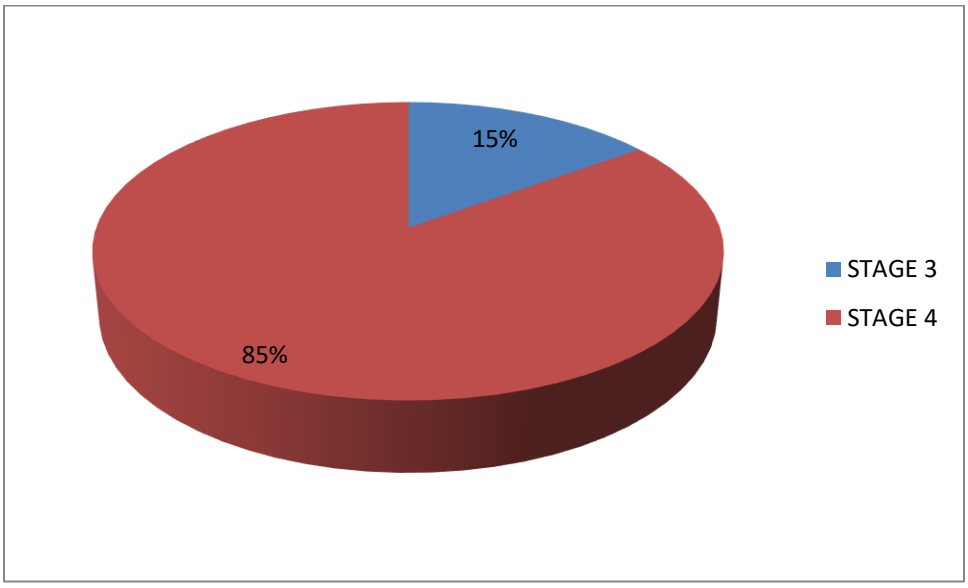
9 were in stage 3.

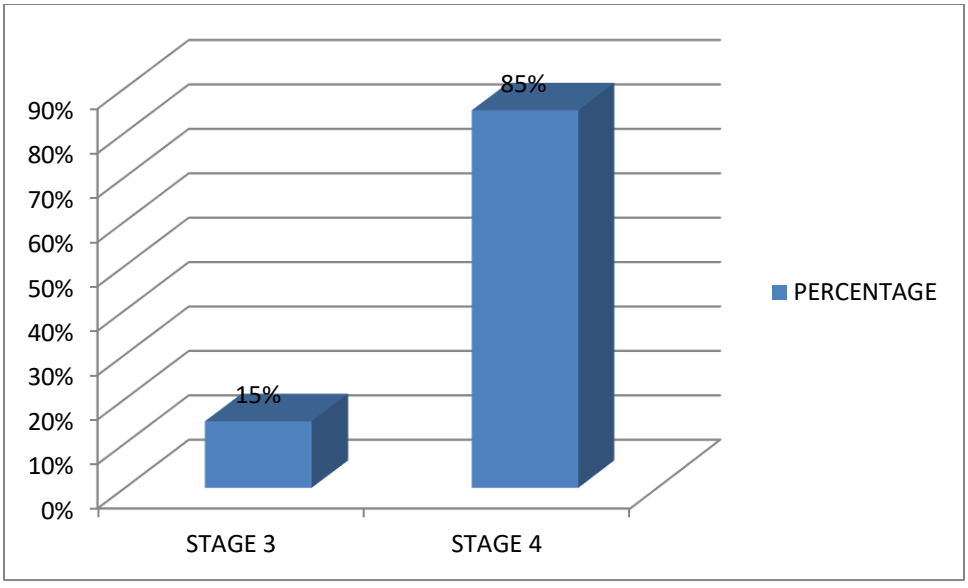
51 were in stage 4.

TABLE – 2 : STAGE DISTRIBUTION OF CKD PATIENTS

STAGE	NUMBER OF PATIENTS	PERCENTAGE
Stage 2	0	0
Stage 3	9	15%
Stage 4	51	85%

FIGURE:8


15%
85%
STAGE 3
STAGE 4


90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
85%
15%
STAGE 3
STAGE 4
PERCENTAGE

Among 9 patients with stage 3 CKD

2 were Female patients

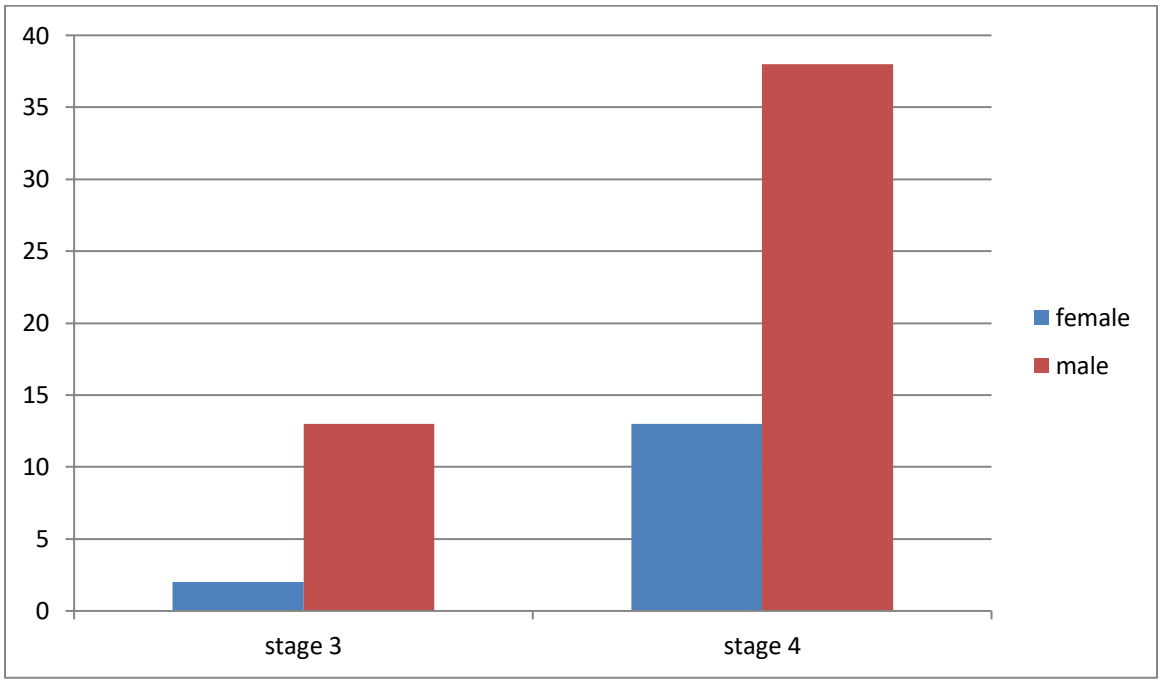
7 were male patients.

Among 51 patients with stage 4 CKD

13 were Female patients.

38 were male patients .

FIGURE:9



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Among the 15 Female patients

3 had Diabetes mellitus as a risk Factor

4 had Hypertension as a risk Factor remaining 8 patients had no risk Factors.

Among the 45 male patients

15 had Diabetes mellitus as a risk Factor.

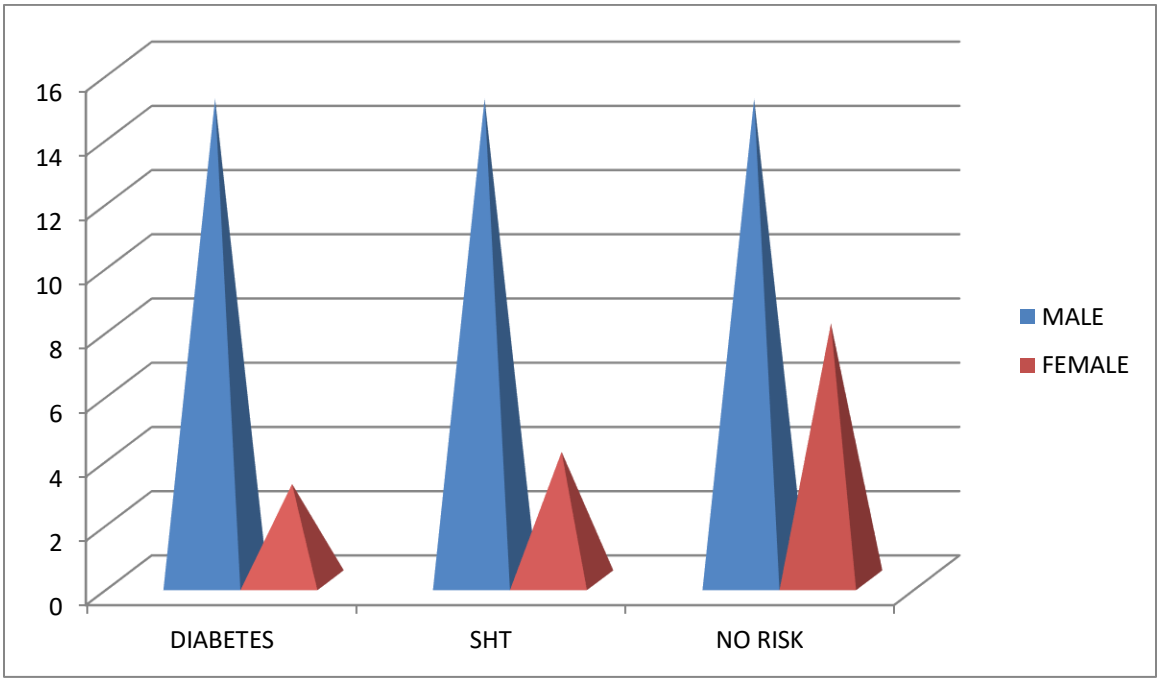
15 had Hypertension as a risk Factor

15 patients were without any risk Factors.

TABLE 3: RISK FACTORS IN MALE AND FEMALE CKD PATIENTS

RISK FACTORS	MALE-CKD	FEMALE-CKD
DIABETES MELLITUS	15	3
HYPERTENSION	15	4
NO RISK FACTORS	15	8

FIGURE 10 :SHOWING RISK FACTORS DISTRIBUTION AMONG MALE & FEMALE CKD PATIENTS.



CKD PATIENTS WITH VITAMIN D DEFICIENCY

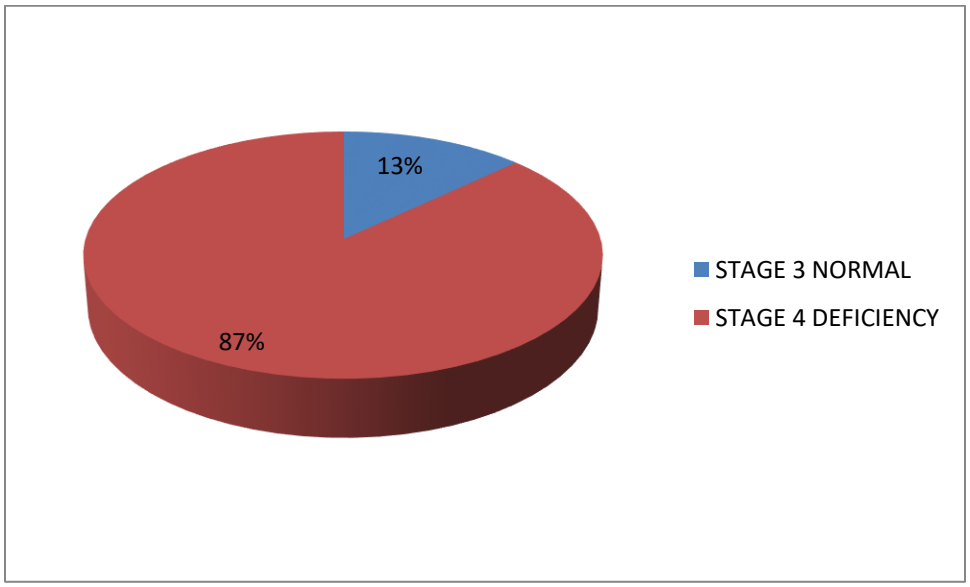
Of the 60 patients included in the study 52 patients had vitamin D deficiency and only 8 patients had sufficient vitamin D Level.

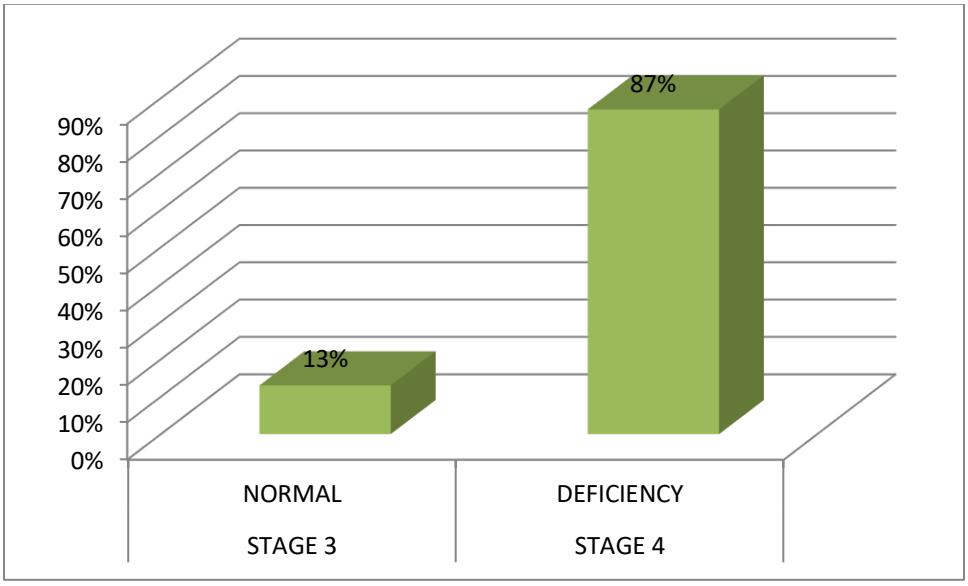
Hence the study shows an increased prevalence of vitamin D deficiency in CKD patients.

TABLE 4: CKD PATIENTS WITH VITAMIN D DEFICIENCY

SERUM VITAMIN D LEVEL	NUMBER OF PATIENTS	PERCENTAGE
NORMAL	8	13%
DEFICIENCY	52	87%

FIGURE:11


13%
87%
STAGE 3 NORMAL
STAGE 4 DEFICIENCY


90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
13%
87%
NORMAL
STAGE 3
DEFICIENCY
STAGE 4

GENDER ANALYSIS OF VITAMIN D DEFICIENCY

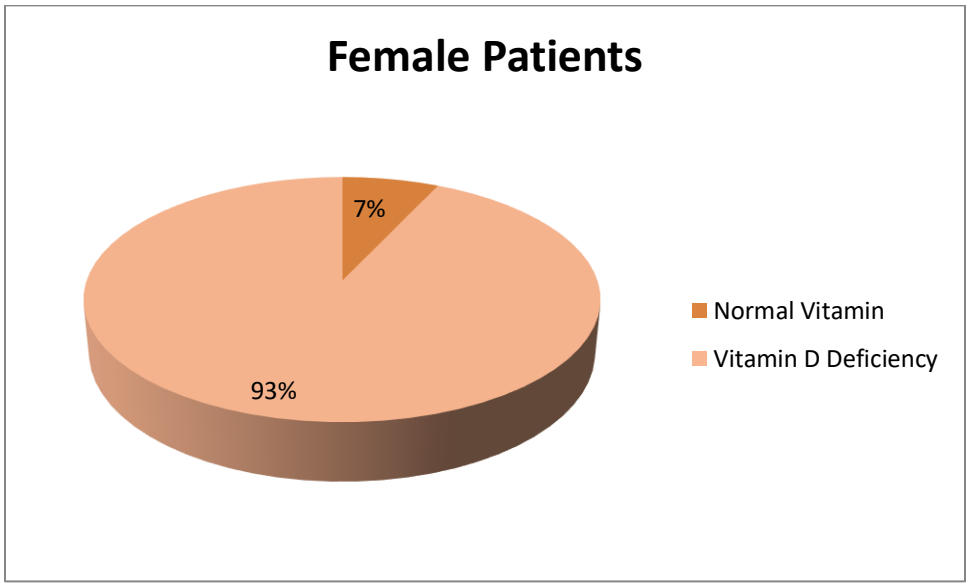
Among the 15 female CKD patients 14 patients had vitamin D deficiency.

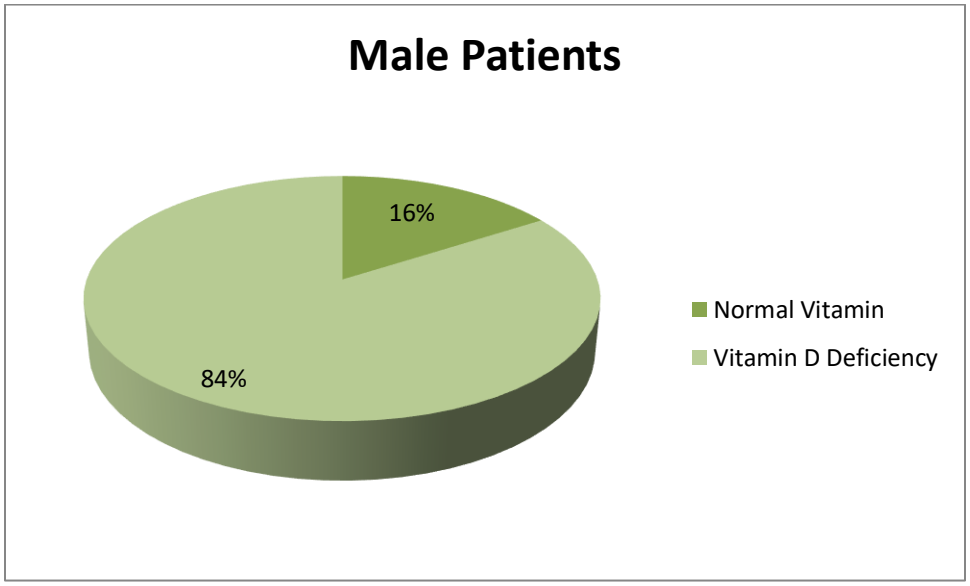
Among the 45 male CKD patients 38 patients had vitamin D deficiency.

TABLE 5: GENDER ANALYSIS OF VITAMIN D DEFICIENCY

SEX	TOTAL NO OF PATIENTS	PATIENTS WITH VITAMIN D DEFICIECY	PERCENTAGE
Female	15	**14**	**93%**
Male	45	**38**	**84%**

FIGURE12:





This analysis shows Female CKD patients have higher vitamin D deficiency prevalence than male CKD patients.

ANALYSIS OF VITAMIN D DEFICIENCY IN MALE CKD PATIENTS WITH HYPERTENSION AND DIABETES MELLITUS.

Out of 15 male patients with Hypertension 13 patients had vitamin D deficiency.

Out of 15 male patients with Diabetes mellitus all patients had vitamin D deficiency.

TABLE 6: RISK FACTOR ANALYSIS OF VITAMIN D DEFICIENCY IN MALE CKD PATIENTS

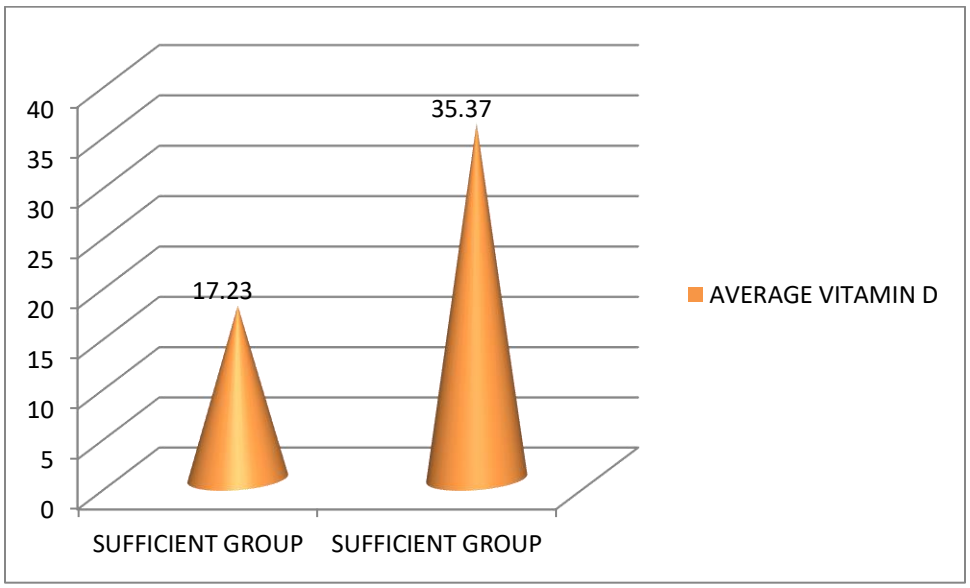
RISK FACTOR	TOTAL PATIENTS	PATIENTS WITH VITAMIN D DEFICIECY	PERCENTAGE
Hypertension	15	13	87%
Diabetes mellitus	15	15	100%

This table shows CKD patients with diabetes mellitus as a risk Factor almost always have vitamin D deficiency as compared to hypertension.

TABLE 7 :AVERAGE VITAMIN D LEVEL BETWEEN TWO GROUPS

VITAMIN D	AVERAGE VITAMIN D
DEFICIENCY GROUP	17.23
SUFFICIENT GROUP	35.37

FIGURE:13



Statistical analysis

item	n	Min.	Max.	Mean	S.D
Age	60	22	75	48.05	10.998
Vitamin d level	60	7.96	42.40	19.8083	8.13228

Age

Particulars	frequency (n=60)	percentage (100%)
Below 30yrs	3	5.0%
31 to 40yrs	15	25.0%
41 to 50yrs	17	28.3%
51 to 60yrs	19	31.7%
61 to 70yrs	5	8.3%
71yrs & above	1	1.7%

Sex

Particulars	frequency (n=60)	percentage (100%)
Male	45	75.0%
Female	15	25.0%

Vitamin d level

Particulars	frequency (n=60)	percentage (100%)
Deficiency (Below 20ng ml)	51	85.0%
Sufficiency (30 to 100 ngml)	9	15.0%

Chi-square test

Age	Female CKD patients		Male CKD patients without any risk factors		Male CKD patients with hypertension		Male CKD patients with diabetes		Total		Statistical inference
	(n=15)	*(100%)*	*(n=15)*	*(100%)*	*(n=15)*	*(100%)*	*(n=15)*	*(100%)*	*(n=60)*	*(100%)*	
Below 30yrs	1	6.7%	0	.0%	1	6.7%	1	6.7%	3	5.0%	X^2=7.872 Df=15 .929>0.05 Not Significant
31 to 40yrs	3	20.0%	5	33.3%	4	26.7%	3	20.0%	15	25.0%	
41 to 50yrs	4	26.7%	6	40.0%	4	26.7%	3	20.0%	17	28.3%	
51 to 60yrs	6	40.0%	3	20.0%	4	26.7%	6	40.0%	19	31.7%	
61 to 70yrs	1	6.7%	1	6.7%	1	6.7%	2	13.3%	5	8.3%	
71yrs & above	0	.0%	0	.0%	1	6.7%	0	.0%	1	1.7%	

Chi-square test

Sex	Female CKD patients		Male CKD patients without any risk factors		Male CKD patients with hypertension		Male CKD patients with diabetes		Total		Statistical inference
	(n=15)	*(100%)*	*(n=15)*	*(100%)*	*(n=15)*	*(100%)*	*(n=15)*	*(100%)*	*(n=60)*	*(100%)*	
Male	0	.0%	15	100.0%	15	100.0%	15	100.0%	45	75.0%	X^2=60.000 Df=3 .002<0.05 Significant
Female	15	100.0%	0	.0%	0	.0%	0	.0%	15	25.0%	

Chi-square test

Vitamin d level	Female CKD patients		Male CKD patients without any risk factors		Male CKD patients with hypertension		Male CKD patients with diabetes		Total		Statistical inference
	(n=15)	*(100%)*	*(n=15)*	*(100%)*	*(n=15)*	*(100%)*	*(n=15)*	*(100%)*	*(n=60)*	*(100%)*	
Deficiency (Below 20ng ml)	9	60.0%	8	53.3%	11	73.3%	11	73.3%	39	65.0%	X^2=7.470 Df=6 .280>0.05 Not Significant
Insufficiency (20 to 30ng ml)	5	33.3%	2	13.3%	2	13.3%	3	20.0%	12	20.0%	
Sufficiency (30 to 100 ngml)	1	6.7%	5	33.3%	2	13.3%	1	6.7%	9	15.0%	

Oneway ANOVA

Vitamin D level	n	Mean	S.D	SS	Df	MS	Statistical inference
Between Groups				385.216	5	77.043	f=1.183 0.004<0.05 Significant
Below 30yrs	3	14.7033	5.06488				
31 to 40yrs	15	21.3240	10.10091				
41 to 50yrs	17	21.5653	8.99189				
51 to 60yrs	19	19.6432	6.18197				
61 to 70yrs	5	13.2000	3.72210				
71yrs & above	1	18.7000	0.00000				
Within Groups				3516.687	54	65.124	

T-Test

Vitamin d level	n	Mean	S.D	t	df	Statistical inference
Male	45	19.7311	8.62121	-.126	58	0.04<0.05 Significant
Female	15	20.0400	6.71095			

T-Test

Age	n	Mean	S.D	t	df	Statistical inference
Male	45	48.04	10.954	-.007	58	.995>0.05 Not Significant
Female	15	48.07	11.517			

Oneway ANOVA

Vitamin d level	n	Mean	S.D	SS	Df	MS	Statistical inference
Between Groups				204.078	3	68.026	0.03<0.05 Significant
Female CKD patients	15	20.0400	6.71095				
Male CKD patients without any risk factors	15	22.2773	9.09594				
Male CKD patients with hypertension	15	19.8380	9.41512				
Male CKD patients with diabetes	15	17.0780	6.90746				
Within Groups				3697.825	56	66.033	

Oneway ANOVA

Age	n	Mean	S.D	SS	Df	MS	Statistical inference
Between Groups				33.917	3	11.306	f=.089 .966>0.05 Not Significant
Female CKD patients	15	48.07	11.517				
Male CKD patients without any risk factors	15	46.87	8.442				
Male CKD patients with hypertension	15	48.33	12.099				
Male CKD patients with diabetes	15	48.93	12.533				
Within Groups				7102.933	56	126.838	

Statistical analysis of our study is significant of vitamin D deficiency in relation to female CKD patients, male CKD patients with diabetes mellitus, male CKD patients with hypertension,male CKD patients without diabetes and hypertension.

DISCUSSION

CKD is now emerged as a global epidemic. It is a strong predictor of premature cardiovascular disease. Numerous studies suggest progression of CKD and its complications particularly cardiovascular complications are related to hypovitaminosis D.

Many studies show patients with CKD have a higher degree of vitamin D deficiency status.

A study by A**. Lenin, GL Bakris, M. Molitch and D.L. Andress** conclude vitamin D deficiency was evident at all stages of CKD. In their study 13% have vitamin D deficiency with eGFR > 80ml/min and >60% in those with eGFR <30ml/min.

Our study shows 36% of patients with stage 3 CKD that is those with eGFR > 30min/min and 92% of stage 4 CKD patients, those with eGFR <30/min had vitamin D deficiency. Our study was consistent with the study of A. Lein et al.

In an another study conducted by **Gonzalez E.A., Sachdeva.A. Oliver D.A** and **Martin K.J**., Conclude 86% of Predialysis patients i.e., patients with stage 3 and stage 4 CKD, had vitamin D deficiency. Their study also conclude 97% of the patients who were undergoing maintenance hemodialysis had vitamin D deficiency. Our study showed 87% of patients with stage 3 and 4 (Pre dialysis patients) had vitamin D deficiency, and consistent with the study of **Gonzalez et al.**

Another multivariate study conducted by **Mohd rozita, A. Gafor halim, Chiew tong** showed higher prevalence of vitamin D deficiency in Female patients with CKD.

A study conducted by **Del valle, Negri AL, Aguirre C**, found that mean 25 (OH) D Levels were significantly higher in men that in women (28.6 ng/ml vs 18.9 ng/ml).

Our study showed 93% of Female CKD patients have vitamin D deficiency as compared to 84% of male CKD patients with vitamin D deficiency. Hence our study is consistant with study by **Mohd rozita et.al.**

In our study the mean 25 (OH) D Levels are almost similar in both men and women (male 19.5 ng/ml us Female 20.04. ng/ml) and contradict with the study by Del valle et al.

A randomized trial of VDRA – vitamin D receptor activity in patients with CKD by **Dr. Rajiv agarwal**, Found that all patients (40 patients) in their study had vitamin D deficiency. Their study also demonstrate patients with proteinuria had higher proportion of vitamin D deficiency our study also witnessed that patients with proteinuria had higher proportion of vitamin D deficiency and consistent with the study of **Rajiv agarwal et al**.

Another study regarding vitamin D and cardiovascular disease risk by **michos, Erin D**, Found 78% of hypertensive patients had vitamin D level in sub optimal range. They also found that 92% Diabetic patients had vitamin D deficiency. Our study showed almost all patients with Diabetes had vitamin D deficiency and 87% of hypertensive patients had sub optimal vitamin D level.

CONCLUSION

1. Our study shows vitamin D deficiency in majority of CKD patients around 87%.
2. Our study shows that female preponderance of vitamin D deficiency as compared to male CKD patients.
3. Our study also shows CKD patients with Diabetes mellitus almost always have vitamin D Deficiency as compared to patients with Hypertension.
4. Since vitamin D deficiency is associated with all stages of CKD, vitamin D has established as an important compound in the management of CKD. In CKD supplementation of 25 (OH) vitamin D is recommended at the inception of the disease and the addition of calcitriol in stage 3.

BIBLIOGRAPHY

1.Richard S. Snell: clinical anatomy by regions.

2. William F. Ganong: review of medical physiology.

3.Bayliss C, Blantz RC: Glomerular haemodynamics. News physiological sci 1986; 1:86.

4.Madsen KM, Tisher CC; structural-functional relationships along the distal nephron Am J physiology 1986;250:F1.

5.Mene p,Simmons MS, Dunn JJ; physiology of the mesangial cells. Physiology review 1989;19:1347.

6.Indian CKD registry data.www.ckdri.com.

7.Indian guidelines for chronic kidney disease. Indian Journal of Nephrology nov 2005.

8.Eknoyan G et al: The burden of kidney disease: Improving global outcomes. Kidney int 66:1310,2004.

9.Go A et al: Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. N Engl J Med 351: 1296, 2004.

10.Kottgen A: Genome wide association stydy in nephrology, Am J Kidney Disease 56:743, 2010.

11.Kronenberg F: Emerging risk factors and markers of chronic kidney disease progression. National review of nephrology 5:677, 2009.

12.Levey AS et al. CKD: Common, harmful and treatable- World kidney day 2007. Am J Kidney disease 2:401,2007.

13.Meyer TW et al: Uremia. N Engl J Med 357:1316, 2006.

14.Sarnak M et al: kidney disease is a risk factor for development of cardiovascular disease: A statement from the American heart association councils on kidney in cardiovascular disease, high blood pressure research,clinical cardiology, and epidemiology and prevention. Circulation 108:2154,2003.

15.Strong K et al : preventing chronic disease : how many lives can we save? Lancet 366:1578, 2005.

16.Tall MW et al: predicting initiation and progression of chronic kidney disease: developing renal risk scores. Kidney international 70:1694,2006

17.Tonelli M et al: using proteinuria and eGFR to classify risk in patients with chronic kidney disease: A cohort study. Ann intern med 154:12,2011.

18.Eknoyan G et al: effect of dialysis dose and membrane flux in maintenance haemodialysis. N Engl J Med 346:2010,2002.

19.Forni LG, Hilton PJ; current concepts: continuous haemofiltration in the treatment of acute renal failure: N Engl J Med 336:1303,1997.

20.Himmelferb J, Kliger AS: end stage renal disease measures of quality, Annual review of medicine 58:387,2007.

21.Anil chandrasekar,Edgar L Milford,Mohamed H.Sayegh: transplantation in the treatment if renal failure. Harrison's principles of internal medicine. 18th edition.

22.Kathleen D. Liu, Glenn M. Chertow: dialysis in the treatment of renal failure. Harrison's principles of internal medicine. 18th edition.

23.Joanne M. Bargman, Karl skorecki: chronic kidney disease. Harrison's principles of internal medicine. 18th edition.

24.Bouillon R et al: Vitamin D and human health: lessons from the vitamin D receptor null mouse. Endocrinology review: 29:726,2008.

25.Deluca HF: Overview of general physiologic features and functions of vitamin D. Am J Clin Nutr 80:1689S,2004.

26.Holick MF: Vitamin D deficiency. N Engl J Med 357:266,2007.

27.F. Richard Bringhurst, Marie B Demay, Stephen M .Krane, Henry M. Kronenberg: bone and mineral metabolism in health and disease. Harrison's principles of internal medicine 18th edition.

28.Artaza JN,Mehrotra R, Norris KC. Vitamin D and the cardiovascular system. Clin J Am Soc Nephrology.2009,4;1515-1522 [pubmed].

29.De Boer IH, Ioannou GN, Kestanbaum B, et al.25-Hydroxyvitamin D Levels and albuminuria in the third national health and nutrition examination survey (NHANES III) Am J Kidney dis 2007,50: 69-77.[pubmed]

30.Zhang Z, Sun L, Wang Y, et al. renoprotective role of the vitamin D receptor in diabetic nephropathy. Kidney int 2008,73:163-171[pubmed].

CONSENT FORM

I _____

here by give consent to participate in the study conducted by postgraduate in Department of General Medicine, Thanjavur Medical College, Thanjavur Medical College& Hospital, Thanjavur.,and to use my personal clinical data and result of investigation for the purpose of analysis and to study the nature of disease. I also give consent for further investigations.

Place :

Date :

Signature of the participant

PROFORMA

AN ANALYTICAL STUDY OF VITAMIN D DEFICIENCY IN CHRONIC KIDNEY DISEASE PATIENTS.

NAME : IP NO :

OP NO :

AGE : DOA : DOD :

PRESENTING ILLNESS :

PAST HISTORY :

DIABETES MELLITUS :

HYPERTENSION :

RECURRENT UTI :

STD :

CHRONIC NSAIDs INGESTION :

PERSONAL HISTORY

SMOKING :

ALCOHOLISM :

FAMILY HISTORY :

CLINICAL EXAMINATION :

GENERAL EXAMINATION :

BP : PR:

CVS:

RS:

P/A:

CNS:

INVESTIGATIONS

CBC :

HB :

TC :

RED CELL COUNT :

PLATELET COUNT :

PCV :

RANDOM BLOOD SUGAR :

FASTING BLOOD SUGAR :

POST PRANDIAL BLOOD SUGAR :

SERUM UREA :

SERUM CREATININE :

SERUM Na+ :

SERUM K+

URINE ANALYSIS:

SERUM VITAMIN D LEVEL :

USG ABDOMEN :

ECG :

S. No	NAME	AGE	SEX	DIABETES	HYPERTENSION	RBS	FBS	PPBS	UREA	CREATININE
1.	Dhanalakshmi	50	F	No	Yes	113mg	82	141	50mg	2.4
2.	Thamaraiselvi	41	F	Yes	Yes	188	169	214	160	5.2
3.	Vembayee	36	F	No	No	119	78	138	136	4.4
4.	Sigappayee	56	F	Yes	-	273	188	248	142	3.2
5.	Vijaya	47	F	No	Yes	94	76	112	110	3.4
6.	Parvathi	60	F	No	No	132	88	136	131	2.8
7.	Nallambal	58	F	No	No	68	78	124	88	2.2
8.	Poongodi	33	F	Yes	Yes	310	142	234	8	3.1
9.	Prema	52	F	No	Yes	92	110	132	96	3.5
10.	Azhagammal	50	F	No	No	72	81	108	110	4.5

S. No	NAME	AGE	SEX	DIABETES	HYPERTENSION	RBS	FBS	PPBS	UREA	CREATININE
11.	Anjammal	67	F	No	No	85	84	112	108	3.5
12.	Manimegalai	34	F	No	No	117	92	138	167	5.0
13.	Padma	32	F	No	No	81	92	130	142	5
14.	Russiya	55	F	No	No	96	84	126	88	2.0
15.	Malliga	56	F	No	Yes	105	88	130	90	1.8
16.	Kumarasamy	50	M	No	No	106	88	124	68	3.6
17.	Azhagar	48	M	No	No	123	82	112	70	3.0
18.	Tamilarasu	40	M	No	No	81	86	121	114	6.0
19.	Murugesan	40	M	No	No	116	92	136	164	6.5
20.	Shanmugam	40	M	No	No	82	104	138	128	7.0

S. No	NAME	AGE	SEX	DIABETES	HYPERTENSION	RBS	FBS	PPBS	UREA	CREATININE
21.	Thangadurai	42	M	No	No	74	78	112	102	4.8
22.	Srinivasan	54	M	No	No	68	76	124	148	6.0
23	Kennedy	35	M	No	No	106	88	136	114	5.1
24	Krishnamoorthi	37	M	No	No	96	76	126	184	8.0
25.	Singarayar	62	M	No	No	117	96	140	154	5.1
26.	Rajendran	47	M	No	No	87	91	126	130	6
27.	Elangovan	47	M	No	No	136	86	134	89	2.4
28.	Pakkirisamy	57	M	No	No	74	70	130	142	5.6
29.	Settu	50	M	No	No	93	82	136	166	6.2
30.	Manikandan	37	M	No	No	92	104	138	112	3.1

S. No	NAME	AGE	SEX	DIABETES	HYPERTENSION	RBS	FBS	PPBS	UREA	CREATININE
31.	Sundarrajan	57	M	No	Yes	124	102	142	146	5.4
32.	Punniyamoorthi	41	M	No	Yes	89	96	130	46	2.8
33.	Madhiyazhagan	55	M	No	Yes	127	102	136	132	4.9
34.	Kamaldeen	47	M	No	Yes	84	90	138	152	5.7
35.	Yesupillai	40	M	No	Yes	83	92	140	166	7
36.	Arumugam	62	M	No	Yes	74	84	130	142	5.1
37.	Arivazhagan	40	M	No	Yes	93	88	132	168	7.3
38.	Jothi	60	M	No	Yes	80	102	138	142	4.7
39.	Vijay	41	M	No	Yes	99	105	138	161	4.7
40.	Ramalingam	30	M	No	Yes	120	102	138	146	4.5

S. No	NAME	AGE	SEX	DIABETES	HYPERTENSION	RBS	FBS	PPBS	UREA	CREATININE
41.	Govintharaj	75	M	No	Yes	86	76	126	102	2.8
42.	Ramachandran	56	M	No	Yes	98	102	134	138	5.4
43.	Ragamathullah	35	M	No	Yes	85	105	138	92	3.0
44.	Sowrinayagam	40	M	No	Yes	98	78	136	130	5.1
45	Jayakumar	46	M	No	No	102	86	140	142	5.7
46	Kumaresan	53	M	Yes	No	188	164	210	84	4.0
47.	Ramesh	38	M	Yes	No	280	194	314	102	3.8
48.	Perumal	55	M	Yes	No	266	210	326	132	4.8
49.	Annadurai	45	M	Yes	No	212	169	246	109	3.5
50.	Saminathan	48	M	Yes	No	159	136	204	145	6.1

S. No	NAME	AGE	SEX	DIABETES	HYPERTENSION	RBS	FBS	PPBS	UREA	CREATININE
51.	Balayan	52	M	Yes	No	178	152	210	114	3.0
52.	Appadurai	60	M	Yes	No	205	146	243	130	5.1
53.	Raman	36	M	Yes	No	152	131	192	96	3.1
54.	Vivek	22	M	Yes	No	170	154	243	152	7.0
55.	Maharajan	55	M	Yes	No	190	162	258	128	4.8
56.	Chandran	55	M	Yes	No	162	180	241	120	4.2
57.	Palani	45	M	Yes	No	146	135	198	126	5.0
58.	Soundarrajan	70	M	Yes	No	167	144	219	133	5.4
59.	Victor	35	M	Yes	No	142	136	202	92	3.0
60.	Kaliyamoorthi	65	M	Yes	No	156	143	218	120	5.0

S. No	NAME	eGFR	Urine Albumin	Urine Deposits	Urine Sugar	Serum Sodium	Serum Potassium	HB	Vitamin D	ECG
1.	Dhanalakshmi	23.3	+	0 – 2	Nil	136	4.8	8.8	21.7	LVH
2.	Thamaraiselvi	17.8	+++	0 – 2	++	130	4.9	8.0	19.1	LVH
3.	Vembayee	16.5	Nil	Nil	Nil	123	3.6	9.8	15.6	NSR, WNL
4.	Sigappayee	15.6	++++	Nil	++	132	5.7	8.8	22.4	NSR, WNL
5.	Vijaya	18	+	Nil	Nil	126	5.1	6.1	36.2	LVH
6.	Parvathi	18.4	Nil	Nil	Nil	134	4.3	7.2	28.4	NSR, WNL
7.	Nallambal	24	Nil	Nil	Nil	142	4.0	10.2	12.6	NSR, WNL
8.	Poongodi	22.2	+++	Nil	+++	142	4.2	9.1	13.8	LVH
9.	Prema	16.7	+	0 – 2	Nil	138	4.3	7.2	20.4	NSR, WNL
10.	Azhagammal	15.8	++	Nil	Nil	131	3.8	4.6	26.5	NSR, WNL

S. No	NAME	eGFR	Urine Albumin	Urine Deposits	Urine Sugar	Serum Sodium	Serum Potassium	HB	Vitamin D	ECG
11.	Anjammal	15.2	++	Nil	Nil	142	3.5	6.7	14.2	NSR, WNL
12.	Manimegalai	15.3	+	Nil	Nil	137	3.4	11.2	23.1	NSR, WNL
13.	Padma	15.6	+	Nil	Nil	140	3.9	6.2	16.4	NSR, WNL
14.	Russiya	30.8	Nil	0 – 2	Nil	144	4.2	13.6	18.9	NSR, WNL
15.	Malliga	33.7	Nil	Nil	Nil	143	4.2	13.0	11.3	LVH+
16.	Kumarasamy	22.5	+	Nil	Nil	140	4.0	8.0	33.33	NSR, WNL
17.	Azhagar	31.0	Nil	Nil	Nil	141	4.3	10.4	36.03.	NSR, WNL
18.	Tamilarasu	16.2	Nil	Nil	Nil	136	3.9	8.4	32.68	NSR, WNL
19.	Murugesan	16.6	Nil	0–2 Puscells	Nil	133	4.9	7.8	11.24	NSR, WNL
20.	Shanmugam	15.4	Ni	Nil	Nil	140	4.6	7.8	11.24	NSR, WNL

S. No	NAME	eGFR	Urine Albumin	Urine Deposits	Urine Sugar	Serum Sodium	Serum Potassium	HB	Vitamin D	ECG
21.	Thangadurai	19.8	Nil	Nil	Nil	129	3.7	8.8	13.33	NSR, WNL
22.	Srinivasan	15.9	Nil	Nil	Nil	123	5.2	7.6	18.21	NSR, WNL
23	Kennedy	18.9	+	Nil	Nil	140	4.3	11.4	21.26	NSR, WNL
24	Krishnamoorthi	15.2	+	Nil	Nil	138	5.2	6.2	19.2	NSR, WNL
25.	Singarayar	16.9	Nil	Nil	Nil	120	4.2	9.6	18.4	NSR, WNL
26.	Rajendran	17.2	Nil	Nil	Nil	131	3.6	8.8	13.4	NSR, WNL
27.	Elangovan	42	Nil	Nil	Nil	132	4.3	13.8	30.9	NSR, WNL
28.	Pakkirisamy	18.6	Nil	Nil	Nil	127	3.0	4.6	19.9	NSR, WNL
29.	Settu	16.6	Nil	Nil	Nil	132	6.0	6.3	24.9	NSR, WNL
30.	Manikandan	36.9	Nil	Nil	Nil	140	4.2	13.2	33.42	NSR, WNL

S. No	NAME	eGFR	Urine Albumin	Urine Deposits	Urine Sugar	Serum Sodium	Serum Potassium	HB	Vitamin D	ECG
31.	Sundarrajan	17.0	Nil	Nil	Nil	117	2.7	7.0	25.6	LVH
32.	Punniyamoorthi	39.2	+	Nil	Nil	140	4.5	14.2	23.43	NSR, WNL
33.	Madhiyazhagan	19.2	+	0–2 Puscells	Nil	128	3.9	10.4	19.21	LVH(+)
34.	Kamaldeen	18.1	++	0–2 Puscells	Nil	114	3.5	8.8	12.29	LVH(+)
35.	Yesupillai	15.8	++	Nil	Nil	118	3.6	8.6	16.48	LVH(+)
36.	Arumugam	17.3	Nil	Nil	Nil	137	6.6	6.6	11.29	LVH(+)
37.	Arivazhagan	15.2	Nil	0–2 deposit	Nil	140	4.7	10.8	15.64	LVH
38.	Jothi	18.9	++	Nil	Nil	120	4.9	6.6	19.21	LVH
39.	Vijay	18.9	Nil	Nil	Nil	139	5.4	10	13.26	LVH
40.	Ramalingam	27.1	++	0–2 deposit	Nil	115	3.9	8.2	19.26	LVH

S. No	NAME	eGFR	Urine Albumin	Urine Deposits	Urine Sugar	Serum Sodium	Serum Potassium	HB	Vitamin D	ECG
41.	Govintharaj	19.3	Nil	Nil	Nil	136	5.1	10.5	18.7	LVH
42.	Ramachandran	16.2	Nil	Nil	Nil	142	6.5	9	38.0	NSR,WNL
43.	Ragamathullah	36.4	Nil	Nil	Nil	145	4.2	12.0	42.4	NSR,WNL
44.	Sowrinayagam	20.8	+	0–2 deposit	Nil	136	43	9.2	13.52	LVH
45	Jayakumar	17.1	Nil	Nil	Nil	148	4.0	7.9	9.28	LVH
46	Kumaresan	22.6	Nil	0–2 deposit	++	153	2.4	8.4	19.26	NSR,WNL
47.	Ramesh	24.2.	+++	Nil	+++	137	4.7	9.0	13.22	NSR,WNL
48.	Perumal	18.4	++	Nil	+++	133	5.5	8.2	17.26	↓‘T’ wave in II, III, avf
49.	Annadurai	26.3	++++	0–2 Puscells	++	130	48	9.2	24.5	NSR,WNL
50.	Saminathan	15.7	++++	Nil	++	141	4.2	5.3	14.1	NSR,WNL

S. No	NAME	eGFR	Urine Albumin	Urine Deposits	Urine Sugar	Serum Sodium	Serum Potassium	HB	Vitamin D	ECG
51.	Balayan	22.4	Nil	Nil	++	142	3.8	10.1	20.42	NSR,WNL
52.	Appadurai	16.3	++	0-2 Puscells	+	133	4.4	5.6	11.42	NSR,WNL
53.	Raman	34.9	++	Nil	+	148	40	9.8	23.42	NSR,WNL
54.	Vivek	15.2	+++	Nil	++	142	4.6	6.2	17.29	NSR,WNL
55.	Maharajan	15.9	+++	Nil	++	130	3.8	7.8	14.33	NSR,WNL
56.	Chandran	18.2	+++	Nil	++	142	4.6	6.2	17.29	NSR,WNL
57.	Palani	17.1	+++	Nil	+	145	3.9	8.2	12.56	NSR,WNL
58.	Soundarrajan	15.2	+++	0-2 Puscells	++	126	4.2	7.2	9.36	‘Q’ wave in II, III, avf V5, V6
59.	Victor	31.5	++	Nil	++	140	4.5	11.8	28.32	NSR,WNL
60.	Kaliyamoorthi	17.6	++	Nil	+	145	3.7	8.9	13.75	NSR,WNL

S. No	NAME	USG Abdomen	Stage of CKD	BP	IP/OP NO
1.	Dhanalakshmi	RK 70x34mm - LK 71x37mm B/L Contracted kidney	4	160/90	OP NO:126643
2.	Thamaraiselvi	B/L Contracted kidney	4	150-90	IP NO: 21011
3.	Vembayee	B/L Contracted kidney	4	110/80	IP NO: 23760
4.	Sigappayee	RK 94x37 mm LK 80x33 mm B/L Type II RPD	4	110/70	IP NO: 25749
5.	Vijaya	RK 77x36 mm LK 80x92 mm B/L Type II RPD	4	180/90	OP NO: 78457
6.	Parvathi	B/L Contracted kidney	4	100/70	OP NP: 56442
7.	Nallambal	B/L Contracted kidney	4	120/70	IP NO: 38705
8.	Poongodi	B/L Contracted kidney	4	160/70	IP NO: 37081
9.	Prema	B/L Contracted kidney	4	140/80	IP NO:38354
10.	Azhagammal	B/L Contracted kidney	4	110/70	IP NO: 37514

S. No	NAME	USG Abdomen	Stage of CKD	BP	IP/OP NO
11.	Anjammal	B/L Type II RPD	4	120/82	IP NO: 38212
12.	Manimegalai	Single Kidney LK contracted Kidney	4	114/80	OP NO: 152776
13.	Padma	B/L Contracted kidney	4	120/70	IP NO: 39442
14.	Russiya	B/L Contracted kidney	3	110/70	OP NO: 94336
15.	Malliga	B/L Contracted kidney	3	150/80	OP NO: 2638/15
16.	Kumarasamy	RK 7.7x3.1cm LK 7.1x2.8cm	4	120/70	IP NO: 20549
17.	Azhagar	RK 62x30mm LK 65x30mm B/L Contracted kidney	3	110/70	OP NO: 148841
18.	Tamilarasu	B/L Contracted kidney	3	120/80	OP NO: 74882
19.	Murugesan	RK 58x28mm LK 64x30mm	4	100/70	IP NO: 19522
20.	Shanmugam	RK 81x34mm LK 81x37mm B/L Contracted kidney	4	106/80	IP NO: 27190

S. No	NAME	USG Abdomen	Stage of CKD	BP	IP/OP NO
21.	Thangadurai	B/L Contracted kidney	1	120/76	IP NO: 28645
22.	Srinivasan	RK 66x24mm LK 81x37mm B/L Contracted kidney	4	110/80	IP NO: 299O8
23	Kennedy	RK 69x30mm LK 61x30mm B/L Contracted kidney	4	120/76	IP NO: 28576
24	Krishnamoorthi	B/L Contracted kidney	4	110/72	IP NO: 39883
25.	Singarayar	RK 64x30mm LK 69x35mm B/L Contracted kidney	4	120/70	IP NO: 26339
26.	Rajendran	B/L Contracted kidney	4	110/60	IP NO: 38570
27.	Elangovan	RK 85x30mm LK 78x32mm B/L Contracted kidney	3	120/80	IP NO: 38536
28.	Pakkirisamy	RK 8.1x3.4mm LK 7.6x3.0mm B/L Contracted kidney	4	170/70	IP NO: 39943
29.	Settu	RK 7.2x30mm LK 74x31mm B/L Contracted kidney	4	110/80	OP NP:168442

S. No	NAME	USG Abdomen	Stage of CKD	BP	IP/OP NO
30.	Manikandan	RK 80x32mm LK 72x33mm B/C Contracted kidney	3	110/80	IP NO:44331
31.	Sundarrajan	RK 64x30mm LK 66x32mm B/C Contracted kidney	4	160/80	IP NO: 20403
32.	Punniyamoorthi	RK 78x34mm LK 80x30mm B/C Contracted kidney	3	140/80	OP NO: 63384
33.	Madhiyazhagan	RK 74x34mm LK 80x32mm B/C Contracted kidney	4	150/86	IP NO:25331
34.	Kamaldeen	RK 86x30mm LK 82x32mm B/C Contracted kidney	4	170/84	IP NO: 25300
35.	Yesupillai	RK 74x28mm LK 68x26mm	4	164/90	IP NO: 26390
36.	Arumugam	RK 64×30mm LK 70×32mm	4	180/90	OP NO: 17339
37.	Arivazhagan	RK 80x30mm LK – not visualized B/C Contracted kidney	4	170/100	IP NO:23641
38.	Jothi	RK 65x28mm LK 68x30mm	4	160/110	IP NO: 26751

S. No	NAME	USG Abdomen	Stage of CKD	BP	IP/OP NO
39.	Vijay	RK 81x33mm LK 8.2x36mm	4	180/100	OP NO: 163329
40.	Ramalingam	RK 73x39mm LK 70x38mm	4	140/80	IP NO:31291
41.	Govintharaj	RK 71x32mm LK 75x30mm	4	150/80	OP NO: 73398
42.	Ramachandran	RK 76x30mm LK 74x30mm	4	130/90	IP NO: 39641
43.	Ragamathullah	RK 75x33mm LK 78x34mm	3	140/80	OP NO: 119342
44.	Sowrinayagam	RK 62x32mm LK 65x30mm	4	160/70	OP NO: 3722
45	Jayakumar	RK 60x28mm LK 63x30mm	4	156/110	IP NO: 39826
46	Kumaresan	RK 70x30mm LK 74x31mm	4	120/70	IP NO: 20490
47.	Ramesh	RK 60x30mm LK 84x34mm	4	110/70	IP NO: 31282
48.	Perumal	RK 70x28mm LK 65x30mm	4	100/60	OP NO: 9942
49.	Annadurai	RK 70x30mm LK 65x28mm	4	110/80	OP NO: 19447
50.	Saminathan	RK 62x30mm LK 65x28mm	4	100/76	IP NO: 40021

S. No	NAME	USG Abdomen	Stage of CKD	BP	IP/OP NO
51.	Balayan	RK 75x32mm LK 70x30mm	4	120/76	IP NO: 38658
52.	Appadurai	RK 62x35mm LK 60x30mm	4	110/70	IP NO: 40762
53.	Raman	RK 76x34mm LK 78x40mm	3	120/78	OP NO: 169438
54.	Vivek	RK 92x45mm LK 96x48mm	4	110/80	IP NO: 44196
55.	Maharajan	RK 90x41mm LK 92x40mm	4	120/78	IP NO:43917
56.	Chandran	RK 78x32mm LK 68x30mm	4	110/60	IP NO: 44175
57.	Palani	RK 75x30mm LK 80x36mm	4	120/74	IP NO: 42317
58.	Soundarrajan	RK 62x28mm LK 66x30mm	4	110/76	IP NO: 41315
59.	Victor	RK 92x41mm LK 90x40mm	3	110/80	OP NO: 58852
60.	Kaliyamoorthi	RK 75x30mm LK 68x32mm	4	120/70	OP NO: 137742